BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JANUARY, 1938.

New dissymmetry in the effect of the electric field on the red hydrogen line. J. STARK and R. RITSCHL (Physikal. Z., 1937, **38**, 870—873).—The dissymmetry of the H_α line in an electric field is a definite effect not dependent on the conditions of experiment. The three p-components (± 2, ± 3, ± 4) show the effect. The theory of the effect is discussed. A. J. M.

Dissymmetry of intensity of light emission of positive rays. J. STARK and H. VERLEGER (Physikal. Z., 1937, **38**, 873—880).—The dissymmetry of intensity of the light emission of positive rays in H_2 and He has been investigated. For H_2, the forward radiation in the direction of the positive rays is less intense than the backward radiation. Along the series of H lines (H_α, H_β, H_γ, H_δ) the polarisation increases with increasing term no., but the dissymmetry of intensity varies only a little, and appears to increase. For He the direction of the intensity dissymmetry is different for ortho- and para-lines. There is no proportionality between the series of vals. of polarisation and intensity dissymmetry. Results are also given for Hg, C, and O lines. In the spark lines of O_2 and C, the polarisation is connected with the intensity dissymmetry. For all the spark lines investigated the backward radiation was more intense than the forward. The effect of intensity dissymmetry therefore appears to be a general phenomenon. The polarisation and intensity dissymmetry have a common axis, the velocity axis of the positive rays. They are not determined by the velocity, but are connected with the characteristic nature of the spectral line. The phenomenon is therefore due to axiality of at. structure. A. J. M.

Molecular spectrum of hydrogen in mixtures of hydrogen and helium. N. D. SMITH (Physical Rev., 1937, [ii], **52**, 728—730).—An investigation of the anomalous rotation discovered by Richardson in the spectrum of H_2 mixed with He is reported. Results agree with Oldenberg's explanation (cf. A., 1934, 1153). N. M. B.

Physical processes in gaseous nebulæ. II. Theory of the Balmer decrement. D. H. MENZEL and J. G. BAKER (Astrophys. J., 1937, **86**, 70—77; cf. A., 1937, I, 436). L. S. T.

Hydrogen emission lines in the spectra of long-period variable [stars]. G. SHAJN (Z. Astrophys., 1935, **10**, 73—85; Chem. Zentr., 1936, i, 3794).—The emission of the Balmer series is correlated with the distribution and intensity of bands due to TiO, ZrO, C_2, CN, CH, etc. H. J. E.

Spectrum of α-Lyrae. J. D. BABBITT (Canad. J. Res., 1937, **15**, A, 161—180).—147 out of 156 lines in the spectrum are identified as arising from H and other elements, largely Fe. The profiles of the stronger lines agree with the results of Pannekoek and Verwey (A., 1935, 908). Total absorptions are recorded. F. R. G.

Fine structure of the helium line λ 4686. W. LEO (Physikal. Z., 1937, **38**, 920—921).—The fine structure of the He 4686 line makes it unsuitable to confirm the Sommerfeld theory of at. structure. A. J. M.

Spectrum of nitrogen and atmospheric pressure at high altitudes. R. BERNARD (Nature, 1937, **140**, 930).—The spectrum of N_2 excited by electron bombardment varies greatly with pressure, but the spectral composition of auroras of a height of several hundred km. remains practically const. The energy of the electrons and not pressure is thus the factor affecting the relative intensity of the radiations emitted (cf. A., 1937, I, 479). L. S. T.

Excitation functions of the auroral bands of N_2^+ and the comet-tail bands of CO^+ excited by electron impact. F. P. BUNDY (Physical Rev., 1937, [ii], **52**, 698—702).—Using a special discharge tube, the excitation functions were determined by photographic intensitometry. The functions were very similar for N_2^+ and CO^+ and rise rapidly from zero at the excitation potential to sharp max. at 2·5 times that potential and then diminish rapidly in exponential manner. The intensities of the 4018 and 4271 A. bands of CO^+ and the 3914 and 4278 A. bands of N_2^+ were measured. N. M. B.

Coronal emission lines observed at the total solar eclipse of June 19, 1936. (A) R. SEKIGUTI. (B) F. J. M. STRATTON (Nature, 1937, **140**, 724—725, 725).—(A) λλ are tabulated and the spectrogram is discussed. The existence of the line 4725 A. is confirmed.

(B) If the above identification is accepted then in the lines 6548 and 6584 A. there is evidence, for the first time, of a known element in the corona, since these lines are " forbidden " lines of N II. L. S. T.

Zeeman effect of the rare gases. J. B. GREEN (Physical Rev., 1937, [ii], **52**, 736—738).—The g vals. are calc. from the at. coupling factors for the $np^5n'p$ configurations (cf. Shortley, A., 1933, 1226) and show good agreement with experiment. From the curves of the g vals. deductions on the genealogy of the terms in these configurations are drawn. N. M. B.

Stark effect of some singlet lines in the alkaline-earth spectra. B. SVENSSON (Z. Physik, 1937,

107, 485—492).—The Stark effect of the Cd lines 4663 and 6439 A. and the 4630 A. Zn line is studied. Results are examined, in conjunction with other work on Mg and Ca, in the light of Unsold's theory. L. G. G.

Spectra of sulphur, potassium, and calcium. H. A. ROBINSON (Physical Rev., 1937, [ii], **52**, 724—725).—Available data are extended by the classification of 27 lines in S III, locating six of the important singlet levels accurately with respect to the known triplets. S IV is completely revised and 14 new terms classifying 18 new lines are added; the corr. ionisation potential is $87{\cdot}610\pm0{\cdot}003$ v. In K VI and Ca VII two new singlet terms with intercombinations are found. One new singlet term is added to K IV and three terms to S VIII. N. M. B.

Accidental induced predissociation in band spectra. E. OLSSON (Naturwiss., 1937, **25**, 781—782).—In investigations of the stability of mols. which are acted on by a magnetic field as a function of the nuclear vibration quantum no. more selective max. than expected are sometimes found. The process to which these additional max. may be due is an accidental predissociation in the sense of Ittmann (A., 1934, 339). The method is applied to S. A. J. M.

Absorption bands due to polarisation molecules of potassium vapour. S. DATTA and B. K. CHAKRAVARTI (Sci. and Cult., 1936, **1**, 478).—Diffuse lines in the absorption spectrum of K vapour at 25 mm. were attributed to mol. formation arising from van der Waals forces. CH. ABS. (*e*)

Determination of the relative transition probabilities in the Bergmann series of Ca. E. KATZ and L. S. ORNSTEIN (Physica, 1937, **4**, 757—760).—Transition probabilities are deduced from the relative intensities of the Ca Bergmann lines (m^3F—3^3D) in a C arc with a CaF_2 core and a Ca electrode arc in N_2. K. S.

Absorption spectra of manganese and silver in Schumann region. F. W. PAUL (Physical Rev., 1937, [ii], **52**, 923—929).—Using a method for observing absorption spectra of materials of high m.p. in the Schumann region, the absorption spectra of Mn and Ag were investigated in the range 800—1930 A. Data, including identifications of new lines in Mn I and a new sequence of terms $d^9snp^6P^0$ in Ag I, are tabulated. N. M. B.

Energy states of valency electrons in some metals. I, 6. Regularities existing in crystal level values and those of atomic spectrum of zinc. M. SATO (Sci. Rep. Tôhoku, 1937, [i], **26**, 206—213).—The electron configurations of the four lowest levels in Zn are E_1 ($4s,4p$; $4s,5p$), E_2 ($4s,4p$; $4s,4d$), E_3 ($4s,5p$; $4s,9p$), E_4 ($4s,5p$; $4s,9d$). F. J. L.

Emission spectrum of diatomic arsenic. II. G. D. KINZER and G. M. ALMY (Physical Rev., 1937, [ii], **52**, 814—821).—Data and analyses previously reported for 2100—3700 A. (cf. A., 1936, 1039) are extended to 7000 A. The heat of dissociation is 3·9 v. Two new systems, one provisionally attributed to As_2^+, have been found. N. M. B.

Electric quadrupole moment of ^{115}In. R. F. BACHER and D. H. TOMBOULIAN (Physical Rev., 1937, [ii], **52**, 836—839).—Measurements of the lines λ 7852 and 8241 A. of In II show deviations from the interval rule, but these are accounted for by the presence of a nuclear electric quadrupole moment which from the first of the lines is found to be $Q = 0{\cdot}82 \times 10^{-24}$ sq. cm. No trace of lines due to ^{113}In was found. N. M. B.

Sensitised fluorescence of tin. J. G. WINANS and R. M. WILLIAMS (Physical Rev., 1937, [ii], **52**, 930—932).—An energy level diagram and energy discrepancies with Hg for 15 lines of Sn (with estimated intensities) observed in sensitised fluorescence and in a low-voltage Tesla discharge are given and discussed. N. M. B.

Electrical and optical properties of iodine vapour. K. G. EMELÉUS, E. B. CATHCART, and C. M. MINNIS (Proc. Roy. Irish Acad., 1937, **44**, **A**, 11—17).—The intensity distribution and the abs. intensity in the electron affinity spectrum of the I atom are calc. The intensity max. is at 3000 A., but even under the most favourable conditions is so feeble that it cannot be observed. The band at 3400 A. is probably not the at. affinity spectrum. F. J. L.

Flame spectrum of europium and persistence of three lines of low excitation. G. PICCARDI (Atti R. Accad. Lincei, 1937, [vi], **25**, 730—733; cf. A., 1934, 49).—The intensities of lines in the flame spectrum of Eu have been studied. O. J. W.

Energy distributions in the spectra of some gaseous discharge tubes. R. G. GIOVANELLI (J. Proc. Roy. Soc. New South Wales, 1937, **70**, 392—401).—The energy distribution in the continuous spectrum and the energy associated with each line in the spectrum in terms of the energy of the neighbouring continuum were determined for discharge tubes containing Hg vapour mixed with He, Ne, A, and a mixture of inert gases, respectively. The luminosity is about equally divided between the continuous spectrum (due to inert gases) and the line spectrum (due to Hg). A. J. M.

Coupling of *p*-electron configurations. H. A. ROBINSON and G. H. SHORTLEY (Physical Rev., 1937, [ii], **52**, 713—723).—The structure and type of coupling of the observed p^2, p^3, and p^4 configurations are considered in detail in terms of the intermediate-coupling theory, in particular for recently analysed long isoelectronic sequences. Full data are tabulated and plotted, and a complete bibliography for atoms with p electrons in the normal configuration is given. N. M. B.

Recombination of ions in the afterglow of a cæsium discharge. F. L. MOHLER (J. Res. Nat. Bur. Stand., 1937, **19**, 447—456).—The radiation and electrical characteristics of the afterglow have been studied. At low pressures the purplish-pink of the discharge gives way to a pale yellow afterglow, but with increase of pressure the colour change is less marked. The rate of fading of the afterglow decreases with increasing pressure, becoming const. at 46 μ. (pressure in μ. of Hg). The appearance of the spectrum of the afterglow supports the view that the glow is a

recombination spectrum. Calculation of the recombination coeff., α, for pressures 46—110 μ. gives a val. $3{\cdot}5 \times 10^{-10}$, assuming negligible diffusion to the walls. Spectral-intensity distribution data indicate that the temp. of the afterglow falls from 2700° K. (temp. of discharge) to 1350° K. at $0{\cdot}9 \times 10^{-3}$ and 1200° K. $1{\cdot}7 \times 10^{-3}$ sec. after interruption of the discharge, and that $\alpha = 3{\cdot}6 \times 10^{-10}$. Electrical measurements of the total no. of ions in the afterglow, and of the flow of ions to the wall, lead to a val. for $\alpha = (3{\cdot}4 \pm 0{\cdot}5) \times 10^{-10}$ for pressures >30 μ.

C. R. H.

Development of the spark discharge. T. E. Allibone and J. M. Meek (Nature, 1937, **140**, 804—805). L. S. T.

Characterisation of the line emission in the long-period variable [stars] as chemiluminescence. K. Wurm (Z. Astrophys., 1935, **10**, 133—153; Chem. Zentr., 1936, i, 3793—3794).—Readily-excited spectra are attributed to three-body recombination processes and inelastic collisions.

H. J. E.

Spectra of comets. M. N. Saha (Sci. and Cult., 1936, **1**, 476).—Ionisation of the upper atm. and the spectrum of the night sky are explained by supposing that the sun does not radiate as a black body in the ultra-violet, but has strong ultra-violet emission lines of He, He^+, H, O, etc. Lines due to CO^+ and N_2^+ in comet-tail spectra are due to ionisation by such radiation. Ch. Abs. (*e*)

Unidentified interstellar lines. P. W. Merrill (Physical Rev., 1937, [ii], **52**, 761—762).—The origin of six slightly diffuse absorption lines in the range $\lambda\lambda$ 5780—6614 is discussed. N. M. B.

Analysis of the intensities of the interstellar *D*-lines. O. C. Wilson and P. W. Merrill (Astrophys. J., 1937, **86**, 44—69).—The interstellar *D*-line intensities measured in the spectra of numerous early-type stars are discussed. Intensities and displacements can be explained by the assumption that Na occurs in large clouds. L. S. T.

Directional distribution of the *X*-radiation from a massive anticathode. H. Determann (Ann. Physik, 1937, [v], **30**, 481—493).—The intensity distribution of *X*-rays from Be, C, and Al anticathodes has been measured at angles from 0° to 110° to the direction of the exciting electron beam and for electron velocities from 35 to 110 kv. The position of the intensity max. is independent of the nature of the anticathode and is not affected by filtering the *X*-rays through 0·4 mm. of Cu. The difference between max. and min. intensity increases with increasing tube voltage and decreases with increasing at. wt. of the anticathode. The influence of electron diffusion is important at high velocities; it causes an increase (7° at 140 kv.) in the angle between the normal plane and the position of max. intensity over that given by Sommerfeld's theory. It is suggested that greater efficiency could be obtained in high-voltage *X*-ray tubes by placing the exit window at an angle $<90°$ to the direction of the electron beam. O. D. S.

Influence of lattice binding on the boron *K* line. E. Gwinner and H. Kiessig (Z. Physik, 1937, **107**, 449—457).—The *K* radiation from B and a no. of its compounds, both conducting and non-conducting, is studied in relation to lattice binding. L. G. G.

***K* Series *X*-ray emission lines of chromium in several compounds.** S. Tanaka and G. Okuno (Proc. Phys.-Math. Soc. Japan, 1935, **17**, 540—547; cf. A., 1935, 1184).—Data for the Cr $K\alpha_1$, α_2, β_1, and β_3 lines from Cr_2O_3, $Cr_2(SO_4)_3$, K_2CrO_4, and $(NH_4)_2Cr_2O_7$ are recorded and discussed.

Ch. Abs. (*e*)

Ionisation by radioactive gamma and cosmic rays in different gases. J. Juilfs (Nature, 1937, **140**, 767—768).—Data for the ionisation produced in H_2, N_2, air, O_2, and CO_2 and the rare gases of the atm. by γ-rays from Ra-*C* and by cosmic rays are recorded. Ionisation is directly $\propto$ the *d* of the gases only in the case of the hard components of the cosmic rays at sea level. L. S. T.

Shot effect of secondary electrons from nickel and beryllium. B. Kurrelmeyer and (Miss) L. J. Hayner (Physical Rev., 1937, [ii], **52**, 952—958).—The secondary emission ratios and shot effects from Ni and Be were measured over a primary energy range up to 1600 v., and conclusions on true secondary electrons, reflected primaries, and primaries buried in the body of the metal and producing no secondaries are discussed in detail. N. M. B.

Propagation of potential in discharge tubes. L. B. Snoddy, J. R. Dietrich, and J. W. Beams (Physical Rev., 1937, [ii], **52**, 739—746; cf. *ibid.*, 1936, [ii], **50**, 469).—The speed of propagation of potential waves in long discharge tubes, of internal diameter 1·7, 5, and 18 mm., containing dry air was measured as a function of pressure. The speed at const. pressure is approx. a linear function of applied voltage. The initial wave from the high-voltage end is followed immediately by a return discharge wave of approx. speed 10^{10} cm. per sec., independent of tube diameter. N. M. B.

Influence of external fields on the electron emission constants of barium-covered platinum surfaces. R. Suhrmann and J. L. von Eichborn (Z. Physik, 1937, **107**, 523—548).—Measurements of the interdependence of electron emission, incident light, externally applied voltage, and previous heat-treatment of Ba-covered Pt surfaces are reported and analysed. H. C. G.

Normal energy distribution of photo-electrons from sodium. C. F. J. Overhage (Physical Rev., 1937, [ii], **52**, 1039—1047).—The Du Bridge theory of normal energy distribution of photo-electrons is re-formulated by including the effect of contact potential. Using a special apparatus, photo-electric currents from Na emitted by monochromatic light were measured after passage through a retarding field, and results varied with changes of the anode potential barrier. Energy distribution curves at different frequencies are mutually consistent, but do not agree with the theoretical normal distribution. The discrepancy is explained in terms of the structure of the anode potential barrier. N. M. B.

Surface photo-electric effect. W. V. Houston (Physical Rev., 1937, [ii], **52**, 1047—1053).—Mathem-

atical. The probability of ejection of an electron is expressed in terms of a function of the potential barrier, energy after ejection, and frequency. The function is expanded in a power series leading to a series of distinctive functions, each having its own temp.-dependence. Results are examined in relation to available data (cf. preceding abstract). N. M. B.

Selenium photo-elements. I. Action of cathode rays of medium velocity. A. BECKER and E. KRUPPKE (Z. Physik, 1937, **107**, 474—484).—The action of cathode rays in the velocity region 1—50 kv. on Se photo-cells sputtered with various thicknesses of Au was examined. Curves showing the interdependence of cell efficiency, intensity of incident electron stream, and electron velocity are given. Results are discussed in relation to the ordinary photo-electric action of the cell and with regard to its possible utility in cathode-ray measurements. H. C. G.

Normal energy distribution of photo-electrons from thin potassium films as a function of temperature. C. L. HENSHAW (Physical Rev., 1937, [ii], **52**, 854—865).—Films $>$ and $<$ monat. thickness produced by the mol.-ray method were investigated and results are compared with the predictions of various theories. The temp. effects are: temp.-dependence of the rates of diffusion of K through and sublimation from the base metal, irreversible changes with temp. in the state of the K surfaces, reversible changes with temp. in the shape of the Fowler plots, and a change of photo-electric current with temp. only 10—30% of that predicted by Du Bridge's theory. The temp. effect seems less with thinner films, a result not predicted by theory. N. M. B.

Thermionic emission of positive ions from molybdenum. H. GROVER (Physical Rev., 1937, [ii] **52**, 982—986).—An equation for the temp. variation of the c.d. of the thermionic positive ions is developed and discussed. Mass-spectrograph studies of Mo and W show that ions of alkali impurities may persist after ageing of the specimens for 1100 hr. and cause an apparent lowering of the measured work function of characteristic ions. An experimental method of eliminating the effect of these impurities is described. The ion work function thus obtained for Mo is 8·9 e.v. N. M. B.

Static measurements on electron beams. K. H. STEHBERGER (Ann. Physik, 1937, [v], **30**, 621—634).—By the application of a longitudinal magnetic field of 800 gauss to a slow, $<$22-v. electron beam in vac. a " winding " beam is obtained in which little spreading occurs. The current between the beam and a cylindrical probe surrounding the beam is very small until electron velocities are reached at which positive ions are formed by collision with gas mols. Measurements have been made of the charge induced on the probe by the beam and of its variation with electron velocity. An electrometer making use of the winding beam is described. O. D. S.

Calculation of the penetration of electrons of some millions of volts. II. S. FRANCHETTI (Atti R. Acad. Lincei, 1937, [vi], **25**, 607—614; cf. A., 1937, I, 591).—Theoretical. O. J. W.

Energy losses of fast electrons. L. J. LASLETT and D. G. HURST (Physical Rev., 1937, [ii], **52**, 1035—1039; cf. Turin, A., 1937, I, 487).—Using activated Cl as an electron source, the energy losses experienced by electrons of energies 1·5—4·5 m.e.v. in traversing thin C and Pb laminæ were investigated with a H_2-filled cloud chamber. The experimental average energy loss per g. per sq. cm. of Pb was markedly $>$ that predicted theoretically; this discrepancy cannot be explained on the basis of the obliquity of electron paths in the absorber. The abs. probability of large energy losses is $\gg$ that expected from theory. N. M. B.

(A) Dissociation processes produced in $SbCl_3$, $AsCl_3$, and PCl_3 by electron impact. (B) Dissociation of HCN, C_2H_2, C_2N_2, and C_2H_4 by electron impact. P. KUSCH, A. HUSTRULID, and J. T. TATE (Physical Rev., 1937, [ii], **52**, 840—842, 843—854).—(A) An investigation of dissociation products shows ions of the type XCl_3^+, XCl_2^+, XCl^+, X^+, XCl_2^{++}, XCl^{++}, X^{++}, and Cl^+. Production efficiencies for various electron energies were investigated, appearance potentials determined, and a partial analysis of results was made.

(B) The dissociation of HCN and C_2H_4 by electron impact has been investigated and an analysis of results and of those previously reported for C_2H_2 and C_2N_2 (cf. A., 1935, 1305) is presented. N. M. B.

Townsend method of measuring electron diffusion and mobility. W. P. ALLIS and (MISS) H. W. ALLEN (Physical Rev., 1937, [ii], **52**, 703—707).—Mathematical. The theory of the Townsend experiment is examined by the Lorentz method. N. M. B.

Electron temperatures and mobilities in the rare gases. (MISS) H. W. ALLEN (Physical Rev., 1937, [ii], **52**, 707—710).—The theory previously developed (see preceding abstract) is applied to the computation of electron temp. and drift velocities in He, Ne, and A. Results are in satisfactory agreement with experiment. N. M. B.

Plasma electron drift in a magnetic field with a velocity distribution function. L. TONKS and W. P. ALLIS (Physical Rev., 1937, [ii], **52**, 710—713).—The Allis–Allen theory (see above) is used to replace previously approx. expressions for the drift motion of electrons in a magnetic field by exact expressions. Good agreement with experiment is found. Tonks' theorem on drift speed (cf. A., 1937, I, 338) is valid within 12%. N. M. B.

(A) Theory of elastic scattering of a beam of particles by atoms. K. C. DAR, M. GHOSH, and K. K. MUKHERJEE. **(B) Elastic scattering of hydrogen and helium.** K. C. DAR (Phil. Mag., 1937, [vii], **24**, 964—971, 971—981).—(A) Theoretical.

(B) The results obtained are extended and applied to the calculation of the intensity of scattered beams at various angles of scattering by H_2 and He. F. J. L.

Scattering of helium positive rays by helium atomic nuclei. C. GERTHSEN (Physikal. Z., 1937, **38**, 833—836).—The angular distribution of He positive rays scattered in He has been investigated

for He rays of velocity 3×10^8 cm. per sec. The results are in agreement with wave-mechanics theory (Mott), rather than with classical theory (Darwin). A. J. M.

Charge transfer of hydrogen and helium canal rays in the velocity range 30—200 e.k.v. H. MEYER (Ann. Physik, 1937, [v], **30**, 635—649; cf. Bartels, A., 1932, 554).—The ratio of charged to uncharged particles in beams of H^+ and He^+ of velocities from 30 to 200 kv. has been measured after passage through He, H_2, and air at different pressures and the equilibrium ratio, w, is calc. The mean free paths of the charged and uncharged particles are calc. l of H^+ increases rapidly with increasing velocity in all gases. For neutral H particles l increases with velocity in He and air, but decreases with velocity in H_2. w of He^+ is $< w$ of H^+ at all pressures. l of He^+ and He are of the same order. For He^+ l increases with velocity in He and air, but shows a min. at about 80 kv. in H_2. For He l decreases in air with increasing velocity, shows a min. in H_2, and remains approx. const. in He. O. D. S.

So-called ion pair. S. KANEKO (J. Chem. Soc. Japan, 1935, **56**, 1265—1266; cf. A., 1933, 464).—An ion pair exists when the positive and negative ions are within the distance $\epsilon^2Z^2/3Dkt$. CH. ABS. (e)

At. wt. of carbon. Ratio of benzoyl chloride to silver. A. F. SCOTT and F. H. HURLEY, jun. (J. Amer. Chem. Soc., 1937, **59**, 1905—1909).—The mean val. of eight analyses gives the ratio BzCl : Ag = $1{\cdot}302999 \pm 0{\cdot}0000035$, from which the at. wt. of C is $12{\cdot}0102 \pm 0{\cdot}00006$. The agreement of this val. with that of Baxter and Hale (A., 1936, 540) suggests that the val. 12·010 should be adopted for the chemical at. wt. of C. J. W. S.

At. wts. of sodium and carbon. A. F. SCOTT and F. H. HURLEY, jun. (J. Amer. Chem. Soc., 1937, **59**, 2078—2079).—Taking the at. wt. of C as about 12·010 (cf. preceding abstract) it is deduced from existing measurements of mass ratios involving Na_2CO_3 that the present international val. of Na is 0·003—0·004 unit too high. J. W. S.

Isotopic composition and at. wt. of neodymium. J. MATTAUCH and V. HAUK (Naturwiss., 1937, **25**, 780—781).—The difference between Aston's val. for the at. wt. of Nd ($143{\cdot}5 \pm 0{\cdot}2$) and that of Hönigschmid (144·27) obtained by chemical methods (A., 1937, I, 592) cannot be accounted for by the existence of only small proportions of ^{148}Nd and ^{150}Nd. The isotopic composition of Nd has therefore been redetermined. The % abundances of the isotopes in Nd were : 142, $25{\cdot}9_5$; 143, 13·0; 144, 22·6; 145, 9·2; 146, 16·5; 148, 6·8; 150, $5{\cdot}9_5$. Assuming a packing fraction of -5×10^{-4}, the at. wt. of Nd on the chemical scale (O = 16) is $144{\cdot}29 \pm 0{\cdot}03$. No new isotopes were discovered. The abundances of any isotopes of mass no. <141, 147, 149, or >150 is $<0{\cdot}3\%$. A. J. M.

At. wt. of lutecium. O. HÖNIGSCHMID (Naturwiss., 1937, **25**, 748—749).—Analysis of $LuCl_3$ by the Ag method gives 174·96 for the at. wt. of Lu, which, after correction for 1·18% Yb in the $LuCl_3$, gives 174·98. This is > Aston's mass-spectrographic val. (174·91). The difference is accounted for by the known existence of another Lu isotope (Gollnow, A., 1937, I, 57). The higher at. wt. requires this to be ^{177}Lu. A. J. M.

Element 87 (Ml). H. HULUBEI (Compt. rend., 1937, **205**, 854—857; cf. A., 1936, 917).—The $L\beta$ and $L\gamma$ spectra of element 87 (moldavium, eka-Cs) have been studied, and feeble rays, distinct from those of other elements, have been detected : $L\beta_1$ 838, $L\beta_2$ 856, and $L\gamma_1$ 715 X. R. S. B.

Mass spectrography and problems of nuclear structure. J. MATTAUCH (Naturwiss., 1937, **25**, 738—747).—A lecture.

Doublets of the C_1 group and binding energy of nuclei between ^{12}C and ^{16}O. J. MATTAUCH and R. HERZOG (Naturwiss., 1937, **25**, 747—748).—The mass differences of the doublets $^{12}CH_2$–^{14}N, $^{12}CH_4$–$^{14}NH_2$, $^{14}NH_2$–^{16}O, $^{14}NH_3$–^{16}OH, $^{12}CH_4$–^{16}O, $^{13}CH_4$–^{16}OH, $^{13}CH_4$–$^{14}NH_3$, and ^{12}CH–^{13}C have been obtained. The mean for ^{12}CH–^{13}C is $43{\cdot}7 \pm 0{\cdot}5 \times 10^{-4}$. A comparison of the results of mass-spectrographic and at. disintegration determinations for the doublets of the C_1 group is made. The binding energies of the nuclei from ^{12}C to ^{16}O are calc. on the basis of the mass differences of the doublets together with ^1n–^{1}H and $^1H_2$–^{2}D. A. J. M.

Isotopic constitution of tungsten. A. J. DEMPSTER (Physical Rev., 1937, [ii], **52**, 1074).—Using pure W electrodes, the existence of ^{180}W of estimated intensity 0·01 that of ^{183}W was confirmed. N. M. B.

Isotopic constitution of osmium. A. O. NIER (Physical Rev., 1937, [ii], **52**, 885).—Using an improved mass-spectrometer, the discovery of a new isotope ^{184}Os (1 part in 5700) is reported. The % abundance relative to ^{192}Os is 0·043. The corr. at. wt. is 190·21. N. M. B.

Mass-spectrographic study of the isotopes of Hg, Xe, Kr, Be, I, As, and Cs. A. O. NIER (Physical Rev., 1937, [ii], **52**, 933—937; cf. A., 1937, I, 57).—A new mass-spectrometer of high intensity and high resolving power for accurate relative abundance determinations is described. Mass-spectrum diagrams for Hg, Xe, and Kr are given. The non-existence of ^{197}Hg is confirmed; ^{208}Hg is very doubtful. Cs, As, and I are single to a very high degree. If ^{8}Be exists it must be $<10^{-5}$ of ^{9}Be. N. M. B.

Isotopic composition of ordinary and uranium-lead. J. MATTAUCH and V. HAUK (Naturwiss., 1937, **25**, 763—764).—The % of ^{204}Pb, ^{206}Pb, ^{207}Pb, and ^{208}Pb in ordinary Pb, and in U-Pb from Katanga curite, has been determined. The % of isotopes in ordinary Pb are ^{204}Pb $1{\cdot}1_5$, ^{206}Pb $24{\cdot}5_5$, ^{207}Pb $21{\cdot}3_5$, ^{208}Pb $52{\cdot}9_5$, which deviate somewhat from Aston's vals. and give (assuming a packing fraction of +1) $207{\cdot}21 \pm 0{\cdot}02$ for the at. wt. (O = 16). The ^{208}Pb line was just visible in the mass spectrum of U-Pb, and was probably due to a slight admixture with ordinary Pb, which was allowed for in finding the % of isotopes present. The vals. for ^{206}Pb and ^{207}Pb were 91·1 and 4·9, respectively, giving $206{\cdot}01 \pm 0{\cdot}02$ for the at. wt. (O = 16). A. J. M.

Statistic character of the laws of radioactive decay and impact distribution in an ionisation chamber. E. SCHÜTTLÖFFEL (Z. Physik, 1937, **107**, 425—440).—Experimental observations on radioactive decay are compared with data calc. from probability functions. L. G. G.

Rate of production of helium from radium. H. DAMIANOVITCH (Ann. Acad. Brasil. Sci., 1937, **9**, 257—262).—The val. of 147·6 cu. mm. per g. per annum is in agreement with the mean val. of Boltwood and Rutherford (A., 1910, ii, 175). Prolonged preliminary heating is required to remove He (cf. A., 1936, 680). F. R. G.

Energy evolved by ionium. L. WINAND (J. Phys. Radium, 1937, [vii], **8**, 429—432).—The energy evolved in the disintegration of Io has been measured directly with an adiabatic calorimeter. Assuming Geiger's val. for the range of the α-particles, the calc. no. of α-rays emitted per sec. by 1 mg. of Io is $18·04 \times 10^4$, and the mean life 116,000 years. Assuming Curie and Cotelle's val. for the no. of particles emitted, their deduced energy and range are $4·751 \times 10^6$ e.v. and 3·28 cm., respectively. A. J. E. W.

Number of α-rays emitted by a thorium active deposit preparation, measured by its penetrating radiation. A. RICOUX (J. Phys. Radium, 1937, [vii], **8**, 388—390).—The Ra-equiv. of the prep. was measured by its γ-ray activity, and the ionisation due to α-rays determined by the Curie abs. method. The ionisation current produced by the α-rays emitted by 1 mg. of Ra-equiv. is 2156 e.s.u.; this gives 1 mc. of Th active deposit = 0·91 mg. of Ra-equiv. A. J. E. W.

Measurements of the range of the α-particles of U-I and U-II with the "sphere method." G. J. SIZOO and S. A. WYTZES (Physica, 1937, **4**, 791—809).—The relation between the range of α-particles measured by the "sphere method" and the extrapolated ionisation range is discussed. The measured ranges for U-I and U-II are 27·47 and 33·0 mm. at 15°/760 mm. The Geiger–Nuttall rule is only approx. obeyed. K. S.

γ-Rays of polonium. H. C. WEBSTER (Nature, 1937, **140**, 852).—These rays may be due to the production of electron-pairs by internal absorption of α-rays (cf. A., 1937, I, 488). L. S. T.

Absorption, scattering, and secondary radiation of hard γ-rays. W. GENTNER (Physikal. Z., 1937, **38**, 836—853),—A comprehensive review dealing with the theory of the Compton and photo-effects (as far as they concern hard γ-rays), the formation of pairs, and annihilation radiation. Experimental results of work on pair formation, the dependence of the absorption of γ-rays on the at. no., the absorption coeffs. in Pb, and the scattering and secondary radiation from hard γ-rays are summarised. A. J. M.

γ-Ray spectrum of ^{10}B. P. G. KRUGER and G. K. GREEN (Physical Rev., 1937, [ii], **52**, 773—776; cf. Bonner, A., 1936, 1174).—An investigation of the γ-rays from ^{10}B, produced by bombarding Be with 1 m.e.v. deuterons, by an examination of the momentum distribution of Compton electrons ejected from a thin mica foil in an expansion chamber shows a spectrum of six γ-rays of energies 0·51, 1·07, 1·44, 1·96, 2·81, and 3·21 m.e.v. resulting from all possible transitions between three excited levels and the ground state of ^{10}B. The energy levels agree with those obtained from a study of the neutron spectrum emitted by the same reaction. N. M. B.

Interaction of neutrons with normal and para-hydrogen. J. R. DUNNING, J. H. MANLEY, H. J. HOGE, and F. G. BRICKWEDDE (Physical Rev., 1937, [ii]. **52**, 1076—1077).—Scattering experiments with a beam of slow neutrons indicate that the cross-section for para-H_2 is $\sim 14 \times 10^{-24}$, and for normal H_2 $\sim 75 \times 10^{-24}$ sq. cm. Results show that spin-dependent forces exist, and that the singlet state of the deuteron is virtual. The *ortho* cross-section is 2·5—3 times the *para* cross-section (cf. Halpern, A., 1937, I, 489; Schwinger, *ibid.*, 543). Measurements of the neutron–proton cross-section, using H_2O, give an average of $42·2 \times 10^{-24}$ for 300° K. neutrons, and $56·0 \times 10^{-24}$ sq. cm. for $\sim 100°$ K. neutrons, a ratio of 1·325. Measurements of O and N cross-sections, using liquid O_2 and N_2, give average vals. of 4·05 and $12·7 \times 10^{-24}$ sq. cm., respectively, for 300° K. neutrons. N. M. B.

Capture of slow neutrons in light elements. O. R. FRISCH, H. VON HALBAN, jun., and J. KOCH (Nature, 1937, **140**, 895).—Vals. for the capture cross-sections of H_2 and N_2 and upper limits in the cases of D_2, C, and O_2 for neutrons of velocity $2·2 \times 10^5$ cm. per sec. have been obtained from measurements of the density distribution of neutrons around a Ra + Be source in different liquids or solutions containing H. The cross-sections of D and Be for photo-dissociation by the γ-rays of Ra have been determined. L. S. T.

Scattering and absorption cross-section of neutrons in cobalt. N. E. BRADBURY, F. BLOCH, H. TATEL, and P. A. ROSS (Physical Rev., 1937, [ii], **52**, 1023—1026).—The low-voltage neutron source described employs the deuteron–deuteron reaction with a continuously renewable target of ND_4Cl formed by sublimation on a metal target cooled with solid CO_2. The sum of the absorption and scattering cross-sections for Co is $26·1 \pm 2·6 \times 10^{-24}$, and the scattering cross-section alone is $5·6 \pm 1·8 \times 10^{-24}$ for C neutrons and $3·7 \pm 1·8 \times 10^{-24}$ sq. cm. for D neutrons. The anomalously large scattering cross-sections of Fe and Ni (cf. Mitchell, A., 1936, 1044) are independent of their ferromagnetism. N. M. B.

Neutron–proton scattering and the disintegration of deuterium by deuterons. T. W. BONNER (Physical Rev., 1937, [ii], **52**, 685—687).—The angular distribution of the scattering by protons of neutrons from the nuclear reaction $^2_1H + {}^2_1H \rightarrow {}^3_2He + {}^1_0n + Q_1$, giving 2·6 m.e.v. neutrons at right angles to the bombarding deuterons, was observed by the method of recoil protons in a cloud chamber. The val. of Q_1 was $3·36 \pm 0·20$ m.e.v. The recoil proton distribution, showing a max. at 45°, agrees with theory. N. M. B.

Scattering of protons by neutrons. P. G. KRUGER, W. E. SHOUPP, and F. W. STALLMANN

(Physical Rev., 1937, [ii], **52**, 678—684).—The neutrons used were produced by bombarding frozen D_2O with 1 m.e.v. deuterons and photographs of recoil proton tracks in a liquid-filled cloud chamber were measured. Corr. curves indicate that the scattering is approx. spherically symmetrical about the centre of gravity, in agreement with theory. N. M. B.

Neutrons from the deuteron–deuteron reaction. R. LADENBURG and M. H. KANNER (Physical Rev., 1937, [ii], **52**, 911—918; cf. A., 1937, I, 108).—The abs. no. of neutrons produced was determined for a target of heavy ice by measuring the scattering cross-section of liquid N_2 and O_2 for these neutrons, and by counting in an ionisation chamber the recoils in N_2 and in O_2 gas due to the scattering of the neutrons. The abs. yield of neutrons is $3{\cdot}0 \times 10^5 \pm 20\%$ per sec. per μa. of deuterons at 100 kv., and of protons, $(2{\cdot}1 \pm 0{\cdot}2) \times 10^5$. The effective cross-section for the neutron-producing reaction is approx. 2×10^{-26} at 100 kv., increasing to 4×10^{-26} at 300 kv., and to $1{\cdot}3 \times 10^{-25}$ at 700 kv. (cf. Amaldi, A., 1937, I, 438). The scattering cross-section of O_2 for the 2·4 m.e.v. neutrons is $0{\cdot}75 \times 10^{-24}$ sq. cm., or 0·6 that of N_2; of H_2 it is $2{\cdot}1 \times 10^{-24}$ sq. cm. N. M. B.

Neutron generator utilising the deuteron–deuteron reaction. W. H. ZINN and S. SEELY (Physical Rev., 1937, [ii], **52**, 919—923).—A simple accelerating tube is described, and the neutron intensity from a heavy ice target is compared with that from a strong Rn–Be source. N. M. B.

Atomic nuclei with respect to radioactivity. J. GRÖGER (Tech. Obzor, 1934, **42**, 387—390).—Theoretical. CH. ABS. (e)

Search for protons from lithium bombarded by radium-C′ α-particles. W. G. SHEPHERD, R. O. HAXBY, and E. L. HILL (Physical Rev., 1937, [ii], **52**, 674—678).—Investigations under improved conditions for proton emission in the angular range 50—120° by comparison of the yields from Li or LiOH and dicyanodiamide indicate that the protons detected from Li targets arose from N_2 contamination. Upper cross-section limits of ^{6}Li and ^{7}Li are computed. The relation of ${}^6_3\mathrm{Li} + {}^4_2\mathrm{He} \rightarrow [{}^{10}_5\mathrm{B}] \rightarrow {}^9_4\mathrm{Be} + {}^1_1\mathrm{H} + Q_1$ and the reverse reaction ${}^9_4\mathrm{Be} + {}^1_1\mathrm{H} \rightarrow [{}^{10}_5\mathrm{B}] \rightarrow {}^6_3\mathrm{Li} + {}^4_2\mathrm{He} - Q_1$ is discussed. N. M. B.

Radioactivity produced by bombardment of lithium with deuterons. J. C. BOWER and D. P. R. PETRIE (Proc. Camb. Phil. Soc., 1937, **33**, 534—539).—The proposed reactions are ${}^7_3\mathrm{Li} + {}^2_1\mathrm{H} \rightarrow {}^8_3\mathrm{Li} + {}^1_1\mathrm{H}$, ${}^8_3\mathrm{Li} \rightarrow {}^8_4\mathrm{Be} + e^-$, ${}^8_4\mathrm{Be} \rightarrow {}^4_2\mathrm{He} + {}^4_2\mathrm{He}$. The half-life of the excited ^{8}Be nucleus is about 10^{-21} sec. and the time taken to reach the end of its recoil track is about 10^{-13} sec. Thus the particles leave the nucleus before it has lost its recoil energy. During the disintegration the particles often leave the nucleus in opposite directions with equal energies. J. A. D.

Nuclear physics. C. Nuclear dynamics. Experimental. M. S. LIVINGSTON and H. A. BETHE (Rev. Mod. Physics, 1937, **9**, 246—390).—A comprehensive review dealing with the sources of nuclear projectiles, the properties of nuclear radiations, and the instruments available for the detection and observation of nuclear reactions. The theoretical data required for working out results of experiments on nuclear reactions (range–energy relationship, momentum and recoil energy, extrapolated and mean range) are considered. A full summary of results of disintegration experiments up to July, 1937, is given. The results of the calculation of nuclear masses from mass-spectrograph and disintegration data are also given. A. J. M.

Ionisation power of fast lithium particles. F. KIRCHNER, H. NEUERT, and O. LAAFF (Ann. Physik, 1937, [v], **30**, 527—533).—The ionisation curve of fast ^{7}Li particles produced by the process ^{9}Be (D; α) ^{7}Li has been obtained, by means of an ionisation chamber, for 8 mm. of the range. The total range is found to be 12 to 12·5 mm. Attempts to detect ^{8}Be particles formed in the process ^{11}B (p; α) ^{8}Be were unsuccessful. This result is explained by the nature of the expected ionisation curve of ^{8}Be. O. D. S.

Disintegration of beryllium and the masses of the beryllium isotopes. J. H. WILLIAMS, R. O. HAXBY, and W. G. SHEPHERD (Physical Rev., 1937, [ii], **52**, 1031—1034; cf. A., 1937, I, 593).—The disintegrations studied for bombarding energies up to 250 kv. are: ${}^9\mathrm{Be} + {}^1\mathrm{H} \rightarrow {}^8\mathrm{Be} + {}^2\mathrm{H}$ and ${}^6\mathrm{Li} + {}^4\mathrm{Hc}$; ${}^9\mathrm{Be} + {}^2\mathrm{H} \rightarrow {}^7\mathrm{Li} + {}^4\mathrm{He} + Q_2$, or ${}^8\mathrm{Be} + {}^3\mathrm{H} + Q_3$, or ${}^{10}\mathrm{Be} + {}^1\mathrm{H} + Q_4$. Efficiency curves are smooth and regular, and abs. yields from a thick target are given. From range measurements of the disintegration products the vals of Q_2, Q_3, and Q_4 are 6·95, 4·32, and 4·44 m.e.v., respectively, and the masses of ^{8}Be, ^{9}Be, and ^{10}Be, 8·0081, 9·0150, and 10·0168. N. M. B.

Beryllium of mass 8. F. KIRCHNER, O. LAAFF, and H. NEUERT (Naturwiss., 1937, **25**, 794).—The stability of the unexcited ^{8}Be nucleus has been investigated. It breaks down into two α-particles making a small angle with each other, the difference in energy between ^{8}Be and the α-particles being small. The breakdown occurs after a very short time. A. J. M.

Maximum energy of the protons from the bombardment of boron by α-particles. E. POLLARD and G. BRUBAKER (Physical Rev., 1937, [ii], **52**, 762).—A search for any long-range group of protons which would reconcile the experimental and calc. energy vals. (3·3 and 4·0 m.e.v., respectively) gave a small and inconclusive yield. The reaction is ${}^{10}\mathrm{B} + {}^4\mathrm{He} \rightarrow {}^{13}\mathrm{C} + {}^1\mathrm{H}$, so that the absence of a proton group of sufficient energy to balance the mass-energy equation indicates that an excited state of ^{13}C having a relatively long lifetime can exist. N. M. B.

Longest [range] proton groups in the transformation of boron with α-rays. H. MAIER-LEIBNITZ and W. MAURER (Z. Physik, 1937, **107**, 509—512).—The proton spectrum of B obtained by bombardment with α-rays from Po has been found to extend to 91 cm. The energy tones of the process ${}^{10}_5\mathrm{B}$ (α; p) ${}^{13}_6\mathrm{C}$ are in reasonable agreement with the masses of the nuclei concerned. H. C. G.

A peculiarity in the transformation of ^{10}B into ^{13}C. W. BOTHE and H. MAIER-LEIBNITZ (Z. Physik, 1937, **107**, 513—522).—The energy balance of the

reaction ^{10}B (α; p) ^{13}C is discussed on the basis of long-range proton measurements (cf. preceding abstract). Two energy tones exist; the first, 3·8± 0·1 e.M.v., gives rise to the ground state of ^{13}C; the second, 3·0±0·1 e.M.v., results either in an excited or metastable state of ^{13}C or in an isomeride. Attempts to prove the existence of the excited or metastable states by detection of γ-radiation or "phosphorescence" failed. H. C. G.

Artificial radioactivity produced by α-particles. L. N. RIDENOUR and W. J. HENDERSON (Physical Rev., 1937, [ii], **52**, 889—900).—Half-lives and thick target yields were measured, and full data are tabulated for the following radioactive isotopes produced by 9 m.e.v. α-particles accelerated in a cyclotron: ^{13}N, ^{17}F, ^{28}Al, ^{30}P, ^{34}Cl, ^{38}K, ^{53}Fe (?), ^{56}Mn, ^{61}Cu, ^{62}Cu, ^{63}Zn, ^{66}Ga, ^{68}Ga, ^{78}Br, ^{82}Rb, and ^{84}Rb. N. M. B.

Efficiency of the production of artificial radioactive substances by slow neutrons. C. J. BAKKER (Physica, 1937, **4**, 863—870).—The efficiency of slow neutrons, from a Ra–Be source (2×10^6 neutrons per sec.), in producing radioactive Cl (35 min.), Br (18 min.), Br (4 hr.), Br (36 hr.), I (25 min.), and Mn (2·5 hr.), using aq. salt solutions, was determined. From the activities 1, 16, 7, 0·6, 3, and 6%, respectively, of the neutrons were found to be effective. Min. vals. for the capture cross-sections were calc. K. S.

Induced radioactivity of scandium. H. WALKE (Physical Rev., 1937, [ii], **52**, 669—673).—Sc_2O_3 bombarded with deuterons and slow neutrons gives ^{46}Sc (half-life 85±2 days) which emits low-energy electrons and soft γ-radiation. The energy distribution of the electrons, investigated by means of a large H_2-filled expansion chamber, shows an upper limit of the spectrum at $0{\cdot}89_5$ m.e.v. in fair agreement with range measurements with Al absorbers. Bombardment of Sc_2O_3 with α-particles gives rise to ^{48}V (half-life 16·2±0·3 days) which emits positrons and γ-rays. Bombardment with fast neutrons from the $^9Be + {}^2H$ reaction gives ^{42}K only, but with neutrons from the $Li + {}^2H$ reaction gives ^{42}K and both ^{43}Sc and ^{44}Sc (cf. Pool, A., 1937, I, 489), half-lives ^{43}Sc 4·0±0·1 hr., and ^{44}Sc 52±2 hr.; both isotopes emit positrons. N. M. B.

Induced radioactivity of titanium and vanadium. H. WALKE (Physical Rev., 1937, [ii], **52**, 777—787).—The radioactivities induced in Ti and V by irradiation with deuterons, slow and fast neutrons, and in Ti with 11 m.e.v. α-particles were investigated. Bombardment of Ti with deuterons induces emission of positrons and hard γ-rays. An analysis of the decay curve shows six isotopes; three chemically inseparable from V are probably ^{48}V (16·0±0·2 days), ^{49}V (33±1 min.), and ^{50}V (3·7±0·2 hr.). The others appear to be ^{51}Ti (2·8 min.), ^{44}Sc (50 hr.) formed in the reaction $^{46}Ti + {}^2H \rightarrow {}^{44}Sc + {}^4He$, and ^{46}Sc (85±5 days). The energy distribution of the positrons emitted by ^{48}V was studied by means of a large H_2-filled cloud-chamber. The max. energy of the positrons from ^{49}V is 1·9 m.e.v. ^{49}V and ^{50}V were formed by bombarding Ti with 11 m.e.v. α-particles, and two new unidentified periods of 68±4 hr. and >180 days were detected. Ti bombarded with fast neutrons probably gives ^{45}Ca, ^{48}Sc, and ^{46}Sc; ^{48}Sc (41±3 hr.) is also produced by the transmutation $^{51}V + {}^1n \rightarrow {}^{48}Se + {}^4He$; there is also evidence of the reaction $^{51}V + {}^1n \rightarrow {}^{50}V + 2\,{}^1n$. ^{52}V (3·9±0·1 min.) has been produced in several reactions. N. M. B.

Neutron-induced radioactivity of long life in cobalt. J. R. RISSER (Physical Rev., 1937, [ii], **52**, 768—772; cf. Sampson, A., 1936, 1172).—The activity arising when Co is bombarded by neutrons is of approx. half-life 2·0±0·5 years and is probably ^{58}Co. Radiations emitted on disintegration show a γ-ray with mass absorption coeff. in Pb of about 0·047 cm.^{2} per g., and a spectrum of soft β-rays of estimated limiting range 30 mg. per cm.^{2} of Al, representing an energy of 160 kv. A group of more penetrating particles, representing probably a relatively infrequent disintegration process, is indicated. N. M. B.

Radioactive isotopes of bromine: isomeric forms of ^{80}Br. A. H. SNELL (Physical Rev., 1937, [ii], **52**, 1007—1022; cf. Blewett, A., 1936, 1043).—A study of nuclear reactions induced by bombarding As, Se, Br, Kr, and Rb with neutrons, deuterons, and electrically accelerated α-particles indicates that the active ^{80}Br exists in two isomeric forms of periods 18 min. and 4·5 hr. Two successive β-transitions occur in the active ^{83}Se and ^{83}Br, and the reaction $^{82}Se \rightarrow {}^{82}Br$ is a new type of transmutation in which the emission of two neutrons apparently follows deuteron capture. Results and identifications are: ^{78}As (65±3 min.), ^{83}Se (17±5 min.), $^{79\text{ or }81}Se$ (57± 1 min.), ^{78}Br (6·4±0·1 min.; positron emitter), ^{80}Br (18·5±0·5 min., and 4·54±0·10 hr.), ^{82}Br (33·9±0·3 hr.), ^{83}Br (2·54±0·10 hr.), Kr 74±2 min., 4·5±0·1 hr., and 18±2 hr.), $^{86\text{ and }88}Rb$ (18±2 min., 18±1 days). All these activities except ^{78}Br and possibly the very weak 18 hr. Kr emit negative electrons. Max. energies of the β-rays of the Br isotopes were found by absorption measurements. ^{78}Br, ^{80}Br (18 min.), and ^{82}Br emit γ-rays. N. M. B.

Induced radioactivity in strontium and yttrium. D. W. STEWART, J. L. LAWSON, and J. M. CORK (Physical Rev., 1937, [ii], **52**, 901—906; cf. Pool, A., 1937, I, 490).—Sr and Y were bombarded with 6·3 m.e.v. deuterons, with 14—20 m.e.v. neutrons, and with slow neutrons. Sr activity arises from deuteron or neutron action on Sr, and possibly, with very weak intensity, by fast neutron action on Y with emission of a proton. Periods and max. energies in Sr, attributed to isomeric forms of ^{89}Sr, are: 3·0±0·1 hr., 0·61 m.e.v., and 55±5 days, 1·9 m.e.v., both negative activities. Activity in Y is obtained when Sr is bombarded with deuterons and when Y is bombarded with deuterons or neutrons. Periods, probably due to ^{88}Y and ^{90}Y, respectively, and max. energies, are: 120±4 min., 1·2 m.e.v. (positive activity), and 60·5±2·0 hr., 2·6 m.e.v. (negative activity). The possible formation of ^{90}Y from $Sr + {}^2H$ may involve the hitherto unobserved complete capture of a deuteron. N. M. B.

Radioactive isotopes of palladium and silver from palladium. J. D. KRAUS and J. M. CORK

(Physical Rev., 1937, [ii], **52**, 763—768).—Bombardment of Pd with 6·3 m.e.v. deuterons yields activities (both negative) of period 17 min. and 13 hr., due to neutron capture and probably attributable to ^{111}Pd and ^{109}Pd, respectively. Bombardment of Pd yields also activities of 26 min. (positive) and 180 hr. (negative), the former due to ^{106}Ag isomeric with that of 180 hr. period due to fast neutron bombardment, and the latter due to ^{111}Ag which can be formed from ^{110}Pd directly by proton capture and indirectly by a chain reaction through ^{111}Pd. There is a strong γ-radiation accompanying the β-emission from 180 hr. ^{106}Ag and little or no γ-radiation from 180 hr. ^{111}Ag. The upper energy limits for the β-spectrum of the 26 min. ^{106}Ag, 13 hr. ^{109}Pd, and 180 hr. ^{111}Ag activities are 2·24, 1·08, and 0·80 m.e.v., respectively. N. M. B.

Spacing of the resonance levels of silver, rhodium, and bromine nuclei. C. Y. Chao and T. H. Wang (Nature, 1937, **140**, 768—769).—The average spacings of the resonance neutron levels of these elements have been calc. from new measurements of the radioactivity induced in them by bombardment with neutrons (Be + Rn source) distributed more uniformly over the energy spectrum by a paraffin scatterer of only 2 mm. thickness. L. S. T.

Angular distribution of the secondary pairs emitted by the action of ultra-radiation and hard γ-rays on lead. H. Adam (Physikal. Z., 1937, **38**, 824—831; cf., A., 1937, I, 106).—The angular distribution of the electron–positron pairs emitted from Pb by ultra-radiation and hard γ-rays was investigated. For ultra-radiation, the upper limit of the angle of the secondary bundles is about 30°. For hard γ-rays from Th-*C*″ there was a max. in the angular distribution curve at 30°, in agreement with the theory of Bethe *et al.* (A., 1934, 1150). A. J. M.

Angular distribution of the secondary pairs emitted by the action of ultra-radiation and hard γ-rays on lead. G. Burkhardt (Physikal. Z., 1937, **38**, 831—833).—A more accurate comparison of the results of Adam (preceding abstract) with the theory of Bethe *et al.* is given. A. J. M.

Radio-elements formed in uranium irradiated by neutrons. I. Curie and P. Savitch (J. Phys. Radium, 1937, [vii], **8**, 385—387; cf. A., 1937, I, 338, 423).—The formation of elements of periods 40 sec., 2, 16, 23, and 59 min., and 2·7 days, on bombardment of U by neutrons from a Rn–Be source, has been confirmed. An element of period 3·5 hr. is also produced, probably by the reaction $^{238}_{92}U + {}^{1}_{0}n \rightarrow {}^{235}_{90}R + {}^{4}_{2}He$, R being an isotope of Th. Absorption measurements show that the β-rays from the 2 min., 16 min., and 3·5 hr. period elements have high energy, probably $< 6 \times 10^6$ e.v. A. J. E. W.

Artificial radioactivity produced by cosmic rays. J. Clay and M. A. van Tijn (Physica, 1937, **4**, 909—912).—Evidence for the production of artificial radioactive material, with a decay time of 8·6 min., by cosmic radiation using an Fe-shielded ionisation chamber is given. K. S.

Cloud-chamber investigations of some cosmic-ray interactions with matter. G. L. Locher (J. Franklin Inst., 1937, **224**, 555—582).—Cloud chambers controlled by coincidence counters were used in investigating tracks produced by cosmic rays, groups of two or three counters being used side by side in a horizontal line. Post-expansion electron tracks were observed in many cases. There is no evidence of β or γ radioactivity induced by the cosmic rays. Ion counts were made on some shower electrons. A few photographs showed nuclear tracks due to cosmic-ray interaction, but the α-emission is low. These nuclei are probably not all due to the same type of agent or process. A. J. M.

Cosmic-ray burst at a depth equivalent to 800 m. of water. Y. Nishina and C. Ishii (Nature, 1937, **140**, 774).—A correction (cf. A., 1937, I, 6). L. S. T.

Cosmic rays on the Pacific Ocean. A. H. Compton and R. N. Turner (Physical Rev., 1937, [ii], **52**, 799—814).—A survey and discussion of records with reference to latitude, season, and temp. N. M. B.

Abnormal zenithal distribution of cosmic rays. M. G. E. Cosyns (Nature, 1937, **140**, 931).—This can be explained by taking into account the diffusion of cosmic rays in air. L. S. T.

Existence of a particle of mass intermediate between the proton and electron. J. C. Street and E. C. Stevenson (Physical Rev., 1937, [ii], **52**, 1003—1004; cf. Neddermeyer, A., 1937, I, 390).—In an attempt to distinguish the singly occurring cosmic-ray particle from an electron or proton, its track density and magnetic deflexion were observed near the end of its range. Results indicate a particle of negative sign and rest mass $130 \pm 25\% >$ the rest mass of the electron. N. M. B.

Passage of very energetic corpuscles through the atomic nucleus. W. Heisenberg (Naturwiss., 1937, **25**, 749—750).—Theoretical. The processes expected to occur when a neutron or proton of very high energy penetrates the nucleus are considered. The process is very similar to the passage of rapid electrons through ordinary matter. A. J. M.

Potassium–argon transformation. A. Bramley (Science, 1937, **86**, 424—425).—A discussion. L. S. T.

Interaction between nuclei and electromagnetic radiation. A. J. F. Siegert (Physical Rev., 1937, [ii], **52**, 787—789).—Mathematical. N. M. B.

Field theory of nuclear interaction. N. Kemmer (Physical Rev., 1937, [ii], **52**, 906—910).—Mathematical. N. M. B.

Validity of methods used in nuclear calculations. D. T. Warren and H. Margenau (Physical Rev., 1937, [ii], **52**, 1027—1031).—Mathematical. A consideration of the Schrödinger perturbation scheme and the linear variation method. N. M. B.

Relation of proton–deuteron to neutron–deuteron scattering. H. Primakoff (Physical Rev., 1937, [ii], **52**, 1000—1002; cf. Tuve, A., 1937, I, 5).—Mathematical. N. M. B.

Metrical field associated with heavy particles. W. H. BARKAS (Physical Rev., 1937, [ii], **52**, 1074).—The identification of the neutrino model with certain solutions of the field equations of the general relativity theory is suggested. N. M. B.

Normal states of nuclear three- and four-body systems. H. MARGENAU and D. T. WARREN (Physical Rev., 1937, [ii], **52**, 790—798).—Mathematical. A variational method is used for calculating the binding energies of ^3H and ^4He. N. M. B.

Thomas–Fermi statistical method. E. FEENBERG (Physical Rev., 1937, [ii], **52**, 758—760).—Mathematical. N. M. B.

Neutrino theory of light in three dimensions. A. SOKOLOW (Nature, 1937, **140**, 810—811). L. S. T.

Physical world-constants. A. HAAS (Naturwiss., 1937, **25**, 733—734).—Theoretical. A. J. M.

Values of the fundamental atomic constants. (A) S. VON FRIESEN. (B) R. T. BIRGE (Physical Rev., 1937, [ii], **52**, 886).—(A) A criticism of Birge (cf. A., 1937, 1, 491). (B) A refutation. N. M. B.

$^1\Sigma^*$—$^1\Sigma$ band system of ionised zinc deuteride. J. W. GABEL and R. V. ZUMSTEIN (Physical Rev., 1937, [ii], **52**, 726—727).—An analysis of five bands of the λλ 2300—2100 system is tabulated and discussed. N. M. B.

Ultra-violet absorption spectrum of ruthenium tetroxide. B. QVILLER (Tids. Kjemi, 1937, **17**, 127).—The absorption spectrum of RuO_4 vapour, and in aq. and CCl_4 solution has been measured. In the gas, maxima occur at 3100 A. and 3850 A. The spectrum is very similar to that of OsO_4. M. H. M. A.

Spectroscopy of ionic crystals and its application to the alkali halides. A. VON HIPPEL (Z. Physik, 1937, **107**, 559; cf. A., 1937, I, 8).—A reply to criticism. H. C. G.

Electron band spectra of the linear triatomic molecules $HgCl_2$, $HgBr_2$, and HgI_2. M. WEHRLI (Naturwiss., 1937, **25**, 734—735).—The band spectra in the Schumann region of the Hg^{II} halides have been photographed and analysed. A. J. M.

Absorption spectrum of uranyl sulphate in aqueous solution. P. PRINGSHEIM (Physica, 1937, **4**, 810).—A correction (cf. A., 1937, 1, 574). K. S.

Near ultra-violet absorption spectrum of acetone vapour. W. A. NOYES, jun. (Trans. Faraday Soc., 1937, **33**, 1495—1498; cf. A., 1935, 10).—Spectra have been measured at 20° and 200°. Each " band " consists of a series of subsidiary max. Complete classification is at present possible only by empirical methods. F. L. U.

Flame spectra of some aliphatic halides. I. (1) Methyl iodide. W. M. VAIDYA (Proc. Indian Acad. Sci., 1937, **6**, **A**, 122—128).—The flame of MeI shows, in addition to bands due to CH, C_2, and OH, about 35 bands in the range 5900—4260 A., degraded towards the red, and belonging to two systems with one common level. Comparison with the flame spectrum of I indicates that the bands are due to IO. A. J. M.

Ultra-violet absorption spectra of the isomerides of Δ^β-butene and Δ^β-pentene. E. P. CARR and H. STÜCKLEN (J. Amer. Chem. Soc., 1937, **59**, 2138—2141).—The spectra of *cis*- and *trans*-Δ^β-butene, *cyclo*hexene, and different samples of Δ^β-pentene have been examined in the vapour phase in the Schumann region. The *cis*-configuration for the Δ^β-butene of higher b.p. is confirmed by the similarity of its spectrum to that of *cyclo*hexene. The *cis*-configuration is assigned to the Δ^β-pentene of higher b.p. The comparative yields of the isomerides of Δ^β-pentene prepared by different methods have been estimated from their absorption spectra. E. S. H.

Substitution and absorption band displacement. X. Pyrene derivatives. G. FÖRSTER and J. WAGNER (Z. physikal. Chem., 1937, **B**, **37**, 353—364; cf. A., 1937, I, 280).—The ultra-violet absorption spectra of solutions of pyrene and mono-substituted derivatives with the substituents Me, Cl, OH, CN, CO_2H, and NH_2 have been determined. The rule previously formulated for the effect of substituents in band displacement (A., 1933, 445) has only limited validity. R. C.

Absorption bands of oxycytochrome-*C*.—See A., 1937, III, 457.

Structure of bodies coloured in the visible from their absorption spectra. (MME.) RAMART-LUCAS (Compt. rend., 1937, **205**, 864—866).—The relation between structure and absorption spectra for org. chromogens is discussed. The absorption spectra of solutions of fluorescein show that two forms are present, a quinonoid (coloured and fluorescent) and a lactonoid (colourless and not fluorescent), of which the first is present in notable quantity in EtOH, but in scarcely detectable amount in Et_2O. R. S. B.

Organic photochemistry. VII. Spectrochemical and photochemical study on cyanine dyes. S. YOSHIMURA and S. SAKURAI (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1270—1311).—The symmetrical and asymmetrical carbocyanines, di- and tri-carbocyanines have been studied. E. S. H.

Light absorption and constitution of some chlorophyll derivatives. A. STERN and F. PRUCKNER (Z. physikal. Chem., 1937, **180**, 321—358; cf. A., 1937, I, 165, 442).—The effects of various substituents on the absorption spectra of the chlorin, purpurin, and porphyrin systems have been examined in dioxan solution, and are discussed with reference to regularities previously observed between light absorption and constitution of chlorophyll derivatives. The ketonic formulation of purpurin is the most probable. Possible structures for chlorin lactone Me_1 ester are discussed. The two isomeric rhodoporphyrin-γ-carboxylic acids have distinct absorption spectra. J. W. S.

Group resonators. XXIII. Influence of physical factors on the absorption spectra of group resonators. XXIV. Spectra of bixin derivatives. D. RĂDULESCU and F. BĂRBULESCU (Bull. Soc. Chim. România, 1936, **18**, 151—160, 161—165; cf. A., 1936, 920).—XXIII. Observations on solutions

of anthracene and pyrene in EtOH, 50% EtOH–glycerol, and paraffin show that the absorption spectra are not affected by the viscosity of the solvent; changes observed in other cases are probably due to solvation effects. Addition of $MgCl_2$ to the EtOH solutions did not affect the spectrum.

XXIV. Extinction coeff. curves in the λ range 2000—5500 A. are given for bixin, its K salt, and its Me ether, and for norbixin; the differences observed are analogous to those occurring in phenols, Na phenoxides, and phenolic ethers. The displacement of the absorption spectrum of crocetin, which otherwise resembles that of anthracene, is due to the polar CO_2H groups. A. J. E. W.

Rotation–vibration spectra of molecules containing the hydrogen isotope of mass 2 in the photographic infra-red. III. The 1·161 μ. band of HDO. L. HERZBERG (Z. Physik, 1937, **107**, 549—558; cf. A., 1934, 1055).—From an analysis of the fine structure of the 1·161 μ. band of HDO, the moments of inertia are obtained for HDO and D_2O and compared with Mecke's vals. for H_2O. The internuclear distance (O—D) and the O valency angle differ but little from the corresponding distance (O—H) and angle in H_2O. L. G. G.

Absorption spectra in the near infra-red of systems composed of hydrogen chloride gas and an organic oxygenated solvent. R. FREYMANN and J. GUÉRON (Compt. rend., 1937, **205**, 859—861).—The infra-red spectra between 0·8 and 1·2 μ. of HCl gas dissolved in MeOH, EtOH, $COEt_2$, Et_2O, dioxan, and C_6H_6 have been studied at −73° to room temp. The CH bands are displaced towards higher frequencies by the HCl, excepting with C_6H_6. The band near 0·94 μ. in Et_2O and dioxan due to C·O·C is strongly suppressed by HCl. In the alcohols the $(OH)_s$ band near 1·04 μ. and the $(OH)_v$ band near 0·96 μ. disappear in presence of HCl. All changes are observed up to room temp. It is inferred that the absence of $(OH)_s$ and $(OH)_v$ bands is incompatible with the formulæ usually assigned to oxonium compounds. R. S. B.

Infra-red spectrographic study of intermolecular linkages. J. ERRERA (Physica, 1937, **4**, 1097—1104).—A general account is given of the spectroscopic evidence for interaction between the OH groups of mols. of the same kind (cf. A., 1936, 776, 1179; 1937, I, 9, 112, 167), and between the OH of H_2O and the O in dioxan, $COMe_2$, $COEt_2$, and Et_2O, and the N in C_5H_5N. F. L. U.

Infra-red absorption of HCl in oxygenated solvents. W. GORDY and P. C. MARTIN (Physical Rev., 1937, [ii], **52**, 1075; cf. West, A., 1937, I, 112).—In view of the absence of HCl lines in the Raman spectra of HCl in non-ionising solvents, transmission curves were obtained for conc. solutions of HCl in dioxan, Et_2O, and EtOAc for the region 2·6—5·8 μ. For each solution, around 4 μ., there is a broad intense unsymmetrical band, very diffuse on the long-λ side, and a less intense band at 3 μ., the former being probably the HCl fundamental. N. M. B.

Infra-red absorption of carbon disulphide. C. R. BAILEY (Nature, 1937, **140**, 851).—The band at 11·4 μ. is a triplet with max. at 884, 878, and 870 cm.$^{-1}$ In spite of the non-polar nature of CS_2, shifts of ~30 cm.$^{-1}$ occur in many bands on passing from the gaseous to the liquid state. The 4·61 μ. band has peaks at 2190·2, 2177·1, and 2165·4 cm.$^{-1}$ L. S. T.

Rotation–vibration bands of methyl fluoride in the photographic infra-red at 11,250 A. S. M. NAUDE and H. VERLEGER (Physikal. Z., 1937, **38**, 919—920).—The rotation–vibration band of MeF at 11,250 A. is composed of a simple series of lines. Every third line is stronger than its neighbours, an effect due to the three H atoms with spin 1/2. A. J. M.

Fundamental frequencies of dicyanogen molecule. S. C. WOO (Z. physikal. Chem., 1937, **B**, **37**, 399—402).—The fundamental frequencies previously suggested (A., 1932, 558) lead to acceptable vals. for the force consts., whereas Eucken and Bertram's val. $\nu(a) = 740$ cm.$^{-1}$ (A., 1936, 557) does not. R. C.

Comparison of absorption spectra in the infra-red of vaporous and liquid amines. (MME.) M. FREYMANN (Compt. rend., 1937, **205**, 852—854; cf. A., 1937, I, 282).—For the third harmonic of the NH band near 1·04 μ. the frequencies are: NH_2Pr^β 10,455, 10,168, and 10,064 (*l*), 10,466, 10,394, 10,130, and 10,000 (*v*); $C_5H_{11}\cdot NH_2$ 10,452, 10,168, and 10,064 (*l*), 10,401, 10,349, 10,130, and 10,000 (*v*); N_2H_4 10,654, 10,557, 10,317, and 10,189 (*l*), 10,583, 10,547, 10,401, 10,362, 10,176, and 10,020 (*v*); NH_2Ph 10,289, and 9999 (*l*), 10,156, 10,054, 9851, and 9727 (?) (*v*); NHPhMe 10,427, 10,212 (*l*), 10,085 (*v*); piperidine 10,801, 10,692, 10,542, and 10,478 (*l*), 10,732, 10,635, 10,500, and 10,375 (*v*); pyrrole 10,413 and 10,116 (*l*), 9961, 9890, and 9818 (*v*). The NH bands of primary aliphatic amines have three components. The four components of piperidine and the two of pyrrole are considered to indicate the existence of several mol. forms in equilibrium, and persist on passage from liquid to vapour. R. S. B.

Variation of the combination spectrum of water with density and pressure. S. A. UCHOLIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 395—398).—With rising temp. the 3200 cm.$^{-1}$ max. in the combination spectrum of H_2O decreases in intensity, disappearing almost completely at >200°, whereas the band with max. at 3530 cm.$^{-1}$ increases in intensity. At *d* 0·0964 and 135 atm. a line is observed at 3646 cm.$^{-1}$, characteristic of the isolated mols., which increases in intensity with decreasing pressure, whereas the intensity of the band diminishes, and finally disappears. The results are interpreted on the basis of interaction between the mols. J. W. S.

Frequency of oscillation on the hydroxyl group in methyl alcohol and its variation with density. G. S. LANDSBERG and S. A. UCHOLIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 391—393).—The combination spectra of liquid and gaseous MeOH have been studied at various temp. and pressures yielding *d* 0·78—0·015. As *d* decreases, the OH band max. is displaced from 3402 cm.$^{-1}$ at *d* 0·78 to 3535 cm.$^{-1}$ at *d* 0·57, without change in the band width. This band almost disappears as the crit. state is approached. At 190° and *d* 0·577 a narrow line

appears, characteristic of isolated mols., the intensity of which increases with decreasing *d*. J. W. S.

Homopolar linkings in some paramagnetic chlorides. D. C. CHAKRABARTTI (Sci. and Cult., 1935, **1**, 158; Chem. Zentr., 1936, i, 3977).—Raman lines which would be expected for undissociated mols. of $MnCl_2$, $CeCl_3$, $NiCl_2$, and $CoCl_2$ in conc. HCl and EtOH solution were not observed. They may be masked by strong absorption. H. J. E.

Raman effect. LXXIV. Cyanamide and derivatives. L. KAHOVEC and K. W. F. KOHLRAUSCH (Z. physikal. Chem., 1937, **B**, **37**, 421—436).—The Raman spectra of $CN{\cdot}NH_2$, $CN{\cdot}NHNa$, and $CN{\cdot}NR_2$ (R = Me, Et, and Pr), but not those of $CN{\cdot}NH_2,2HCl$ and dipropylcarbodi-imide, exhibit a C:N frequency. The spectra show that in solid, molten, or dissolved $CN{\cdot}NH_2$ there are present at least two mol. forms in equilibrium. One form is certainly $NH_2{\cdot}C{:}N$ and the other is probably NH:C:NH; a third form may also be present. Force consts. of the C:N linking have been calc. The utility of the concept of "characteristic group vibration frequency" is discussed. R. C.

Raman effect. LXXV. Imido-ethers. K. W. F. KOHLRAUSCH and R. SEKA (Z. physikal. Chem., 1937, **B**, **38**, 72—80).—The Raman spectra of $NH{:}C(OEt)_2$, NHAcEt, and various imido-ethers (I) have been determined. The results show that (I) have the structure NH:CR·OR′. In the transition from C·NH·C to C:NH the NH-frequency does not change, which agrees with Förster's theory (A., 1937, I, 398). R. C.

Raman spectra of *dextro-*, *lævo-*, and racemic forms of borneol and camphor. B. V. THOSAR and B. K. SINGH (Proc. Indian Acad. Sci., 1937, **6**, **A**, 105—111).—The Raman spectra of the above compounds in the cryst. state have been examined. The spectra of *d*- and *l*-forms of borneol and camphor are identical in position, intensity, and structure. The *dl*-forms give the same Raman lines as the *d*- and *l*-forms of the two substances. The lines are thus unaffected by the intermol. forces binding *d*- and *l*-mols., which forces must, therefore, be small. The Raman frequencies are considered in connexion with the constitution of the compounds. A. J. M.

Quenching of fluorescence of mercury halides by different gases. S. TIBILOV (J. Phys. Chem. Russ., 1937, **9**, 71—87).—Excited HgX mols. (X = I, Br, Cl) have been produced by optical dissociation of HgX_2 mols.: $MgX + h\nu \rightarrow (HgX)^* + X$, and the effect of NH_3, O_2, CO_2, N_2, CO, A, and H_2 on the intensity of fluorescence was investigated. The quenching efficiency decreases from NH_3 to H_2; HgI fluorescence is more easily quenched than that of HgBr and especially that of HgCl. Strongly vibrating mols. show an easier exchange of energy by collisions than the non-vibrating ones. E. R.

Modification of the phosphorescence of a zinc sulphide semi-conductor under the influence of an electric current. G. DÉCHÊNE (Compt. rend., 1937, **205**, 850—852).—The extinction of the phosphorescence of a ZnS screen by an electric current (cf. A., 1935, 1055) is sometimes preceded by a brief over-excitation of the phosphorescence. The influence of the current has been studied on the phosphorescence appearing on heating some time after the extinction. R. S. B.

Dielectric constant of a space containing electrons. S. P. PRASAD and M. N. VERMA (Z. Physik, 1937, **107**, 441—448; cf. A., 1936, 666).—The influence of "life-period" of the electron and the magnitude of the high-frequency potential on ϵ for electron-containing spaces is discussed. In contradiction of the simple Larmor formula, it is shown that ϵ is not <1. The variation in ϵ with applied high-frequency potential is a parabolic function. L. G. G.

Electric spectrum of liquid water for λλ 5—20 cm. H. W. KNERR (Physical Rev., 1937, [ii], **52**, 1054—1067).—Using a magnetron generator to produce continuous electromagnetic radiation, *n* and the absorption index of H_2O were determined for 19 wave-lengths in the range 5—20 cm. by the conventional free wave method and by a more convenient wire wave method, the two showing close agreement. The absorption index increased steadily from 0·048 at 20·44 cm. to 0·153 at 4·80 cm. The average val. of *n* was 8·80±0·6%. There was no certain evidence of dispersion, but a slight variation is to be expected. N. M. B.

Absorption bands in polar substances at very high radio-frequencies. III. *n*-Propyl and octyl alcohol. L. CAVALLARO (Atti R. Accad. Lincei, 1937, [vi], **25**, 626—631; cf. A., 1937, I, 601).—Measurements for Pr^nOH and $C_8H_{17}{\cdot}OH$ are recorded. With increasing no. of C atoms, the max. absorption is displaced towards longer λλ, in agreement with Debye's theory. O. J. W.

Analogy between the structures of polar liquids and electrolytic solutions. F. H. MÜLLER (Z. Elektrochem, 1937, **43**, 863—869).—Just as an ion in solution is surrounded by a preponderance of ions of opposite sign, so in a polar liquid each dipole is surrounded by preferentially oriented dipoles. These atmospheres have analogous influences on certain physical properties. Among properties considered are: osmotic behaviour (with analogies between effects formerly attributed to incomplete dissociation in electrolytes and to association in polar liquids), behaviour in the electric field (Λ on the one hand and ϵ on the other), η, and effects due to relaxation time (change of Λ and ϵ, respectively, at high frequencies). F. J. G.

Dielectric properties of acetylenic compounds. IX. Acetylenic aldehydes and ketones. H. L. GOEBEL and H. H. WENZKE (J. Amer. Chem. Soc., 1937, **59**, 2301—2302; cf. A., 1937, I, 498).—The electric moments of PhCHO, butyl-, amyl-, and phenyl-propiolaldehyde, COPhMe, butyl-, amyl-, and phenyl-acetylacetylene are, respectively, 2·77, 3·17, 3·18, 3·36, 2·77, 3·20, 3·20, 3·23 ($\times 10^{18}$). The higher moments of the acetylenic aldehydes and ketones in comparison with those of the alkyl and Ph derivatives are explained by the contribution of highly polar structures in resonance with the classical form. E. S. H.

Effect of pressure on refractive index of CO_2. The Lorentz–Lorenz formula. A. MICHELS and J. HAMERS (Physica, 1937, **4**, 995—1006).—The *n*

of CO_2 has been measured at pressures up to 2400 atm. at 25°, 32°, 50°, and 100°, for six different λλ. The apparatus is described. The Lorentz–Lorenz function decreases, to a max. of 2·3%, with increase of pressure. It is suggested that the decrease is partly due to deformation of the electronic orbits of the mols. F. L. U.

Refractive index of the alkali halides. L. W. PARKIN (Phil. Mag., 1937, [vii], **24**, 890—904).—n of 0·002—0·0002N-CsCl, -LiF, -NaF, -KF, -NaI, -KI, and -CsI solutions has been measured, using a Hilger Rayleigh refractometer. The refractivity function $\psi = (1000/c_v)[(n^2-1)/(n^2+2) - (n_0^2-1)/(n_0^2+1)]$ increases linearly with dilution as far as 0·0008N, and then remains const. The difference between these const. vals. for two salts containing a common ion is const., indicating that ionic deformation is absent. F. J. L.

Relationship between deviations from the additivity of the refraction of halogenated methane derivatives and some of their physical and chemical properties. J. M. STEVELS (Chem. Weekblad, 1937, **34**, 678—681).—n_D^{20} and d_4^{20} have been measured for CH_2Cl_2, $CHCl_2F$, $CHCl_3$, CCl_3F, CCl_4, CH_2ClBr, $CHCl_2Br$, CCl_3Br, CH_2Br_2, $CHBr_2F$, $CHClBr_2$, $CHBr_3$, CBr_4, MeI, CH_2IF, CH_2ClI, $CHCl_2I$, CCl_3I, CH_2I_2, and CHI_3. The results are discussed briefly. S. C.

Refractivity intercept and the specific refraction equation of Newton. II. Electronic interpretation of the refractivity intercept and of the specific refraction equations of Newton, Eykman, and Lorentz–Lorenz. S. S. KURTZ, jun., and A. L. WARD (J. Franklin Inst., 1937, **224**, 583—601; cf. A., 1937, I, 13).—The physical bases of the Lorentz–Lorenz and the Sellmeier–Drude equations are compared. Empirical evidence shows that the former equation is invalid for non-polar liquids. On the other hand, the validity of the Eykman equation for the effect of temp. and pressure on n or dielectric const. and that of the Sellmeier–Drude dispersion equation is confirmed. Equations available for correlating n and d with electronic properties of mols. are collected according to type. The derivation of the Sellmeier–Drude and Lorentz–Lorenz equations from the fundamental electrostatic field relations is considered, and indicates the superiority of the former. A. J. M.

Molecular refractions and molecular volumes of glasses. W. BILTZ, F. WEIBKE, and L. SCHRADER-TRAEGER (Z. anorg. Chem., 1937, **234**, 253—288).—$[R]$ for glasses is strictly additive in terms of the component oxides. The mol. vol. is additive to within 1% when account is taken of the state of combination of SiO_2. n can be calc. within a few hundredths of 1% from ρ and analytical data. The results are discussed in the light of theories of the structure of glasses. F. J. G.

Rotatory dispersion in the amine series. I. *d*-*spiro*Heptanediamine and its derivatives. T. M. LOWRY and W. C. G. BALDWIN. **II. *l*-*sec*.-Butylamine and its derivatives. III. Absorption spectra of diamines.** W. C. G. BALDWIN (Proc. Roy. Soc., 1937, **A**, **162**, 204—214, 215—227, 228—232).—I. Theoretical rotatory powers of a series of *spiro*heptane derivatives, calc. from Born's theory, agree with observed vals. when long side-chains are absent. The absorption spectra of *spiro*heptanediamine, its salts, and Ac and Bz derivatives have been examined and discussed. The rotatory dispersions of these compounds and of "diamidocarbonamino*spiro*heptane" were correlated with absorption measurements. Bases on neutralisation undergo large changes of rotatory power due to saturation of the "lone pair" of electrons on the N atom, which usually give rise to circularly dichroic absorption bands. Amino-bases are divided into two classes according as the absorption bands in the 2300 A. region are active or inactive. When these bands are inactive, neutralisation of the base produces practically no change in rotatory power; the *spiro*heptane base belongs to this class.

II. The change of sign in passing from *l*-*sec*.-butylamine (I) to its hydrochloride is discussed with reference to Boys' rule. The rotatory dispersion of (I) is attributed to circular dichroism in the absorption bands at 2200 A. associated with a "lone pair" of electrons on the NH_2-N atom, and anomalous rotatory dispersion of (I) is explained. The rotatory dispersion of acylbutylamines, butylcarbamide, and NH_3BuCl is simple, activation of the "lone pair" of electrons occurring only in the free base. A new theory accounting for the observed changes of rotatory power of amino-bases on neutralisation is confirmed by the observation that saturation of the "lone pair" of NEt_2Bu displaces the active λ from Drude dispersion equations towards the ultra-violet. Lowry's results for nicotine are re-interpreted according to this theory.

III. Absorption spectra of aq. solutions of N_2H_4 and $(CH_2{\cdot}NH_2)_2$ and their hydrochlorides seem to indicate that the band at about 2200 A. is characteristic of the "lone pair" of electrons on the N atom and can be suppressed progressively as the basicity of the solutions is decreased. W. R. A.

Magnetic rotation spectra of diatomic molecules. T. CARROLL (Physical Rev., 1937, [ii], **52**, 822—835).—The general theory of the Faraday effect associated with a single mol. absorption line is presented. The effect of the perturbation of the transition probabilities by the field in producing asymmetrical rotation is discussed, and calc. for alkali band systems and for I_2. N. M. B.

Kerr effect and molecular association in benzene derivatives. N. DALLAPORTA and G. DASCOLA (Nuovo Cim., 1936, **13**, 1—10; Chem Zentr., 1936, i, 3813).—Kerr consts. for *o*-, *m*-, and *p*-xylene, *o*-, *m*-, and *p*-$C_6H_4Cl_2$, and *o*-, *m*-, and *p*-C_6H_4MeCl are determined; they bear a const. ratio to the calc. vals. but the cause of the divergence is not clear. For C_6H_4MeCl the change of the const. with temp. is in agreement with theory. H. N. R.

Molecules. N. V. SIDGWICK (Science, 1937, **86**, 335—340).—A lecture. L. S. T.

Arrangement of the valencies in four-co-ordinated palladium and platinum. Crystal structure of potassium palladochloride. W.

THEILACKER (Z. anorg. Chem., 1937, **234**, 161—178).—The results of Dickinson (A., 1923, ii, 25) for the crystal structure of K_2PdCl_4 are confirmed. The optical activity shown by certain spiran-like four-co-ordinated Pd and Pt compounds can be reconciled with a co-planar arrangement of valencies around the central atom by supposing that the chelate 5-rings are non-planar, and support for this view is obtained by considering space-models in which account is taken of the bond lengths. F. J. G.

Energy bands in the body-centred lattice. M. I. CHODOROW and M. F. MANNING (Physical Rev., 1937, [ii], **52**, 731—736).—Slater's method of finding electronic energy band structure (cf. A., 1934, 828) is extended to satisfy boundary conditions at 14 points of the polyhedral cell surrounding an atom. N. M. B.

Spectrum of normal frequencies of a polar linear lattice. E. K. BROCH (Proc. Camb. Phil. Soc., 1937, **33**, 485—501).—Mathematical. The frequency of the normal vibrations and the vibration spectrum are worked out for a one-dimensional chain. The quasi-elastic binding forces previously used by Born and Karman are replaced by the real forces comprising the electrical interaction of the charges and the repulsive forces. The method also applies in principle to the three-dimensional lattice. The vibration spectrum obtained agrees fairly well with that of the Born–Karman model if the binding const. is adjusted to give the same density of low-frequency modes. The calculations are of importance in connexion with the thermal and optical properties of lattices. J. A. D.

Empty lattice test of the cellular method in solids. W. SHOCKLEY (Physical Rev., 1937, [ii], **52**, 866—872).—Mathematical. The method is accurate in the first Brillouin zone but may be in error by a factor 2 in the second; hence calculations of occupied levels in Li and Na are probably good, but for Cu, Ca, diamond, LiF, and NaCl are liable to errors. Calculations of excited states are subject to considerable error. N. M. B.

Energy and screening constants of the hydrogen molecule. C. A. COULSON (Trans. Faraday Soc., 1937, **33**, 1479—1492; cf. A., 1935, 810).—Mathematical. The mol. orbital and electron-pair treatments of the ground state of the H_2 mol. are almost equally valid. F. L. U.

Valency-bond treatment of the oxygen molecule. G. W. WHELAND (Trans. Faraday Soc., 1937, **33**, 1499—1502).—Mathematical. F. L. U.

Rotational energy of methane. A. W. MAUE (Ann. Physik, 1937, [v], **30**, 555—576).—Theoretical. The rotational energies of CH_4, CH_3D, CH_2D_2, CHD_3, and CD_4 are calc. CH_4 and CD_4 exist in three, and the other methanes in two, forms separated by forbidden transitions. The difference in the temp. increase of rotational energy in the compounds cannot be entirely explained by their differing moments of inertia. The gases with dissimilar substituents reach the point of half saturation of rotational energy at lower temp. than mols. with similar substituent atoms, when allowance has been made for difference in moment of inertia. The rotational energy at equilibrium, when the transition barriers are removed, and the entropy of the gases at low temp. in the region of vanishing rotational energy are calc. O. D. S.

Critical potentials of molecules. J. SAVARD (Rev. Fac. Sci. Istanbul, 1937, **2**, 235—259).—The ionisation potential of CO and the resonance potentials corresponding with the addition of two spectral terms have been determined by electronic bombardment methods. The data are consistent with a val. 8·8 v. for the dissociation energy of CO. Crit. potentials 13·5, 16, and 19·1 v. correspond with the formation of ions CO^+, $^2\Sigma_g^+$; CO^+, $^2\Pi$; and CO^+, $^2\Sigma_u^+$, respectively. C. R. H.

Effective cross-section of non-spherical particles. F. EIRICH and R. SIMHA (Z. physikal. Chem., 1937, **180**, 447—463).—The mean free path and the collision cross-sectional area have been calc. for a gas consisting of rigid ellipsoidal mols. under such conditions that the mean free path is large compared with the mol. dimensions. The results agree, on the whole, with existing experimental data for the viscosity of gaseous paraffins. The possibility of calculating the axial ratio of a coiled-up mol. formed from a chain having internal mobility is discussed. R. C.

Interaction of molecules in anisotropic liquids. W. KAST and W. MAIER (Physica, 1937, **4**, 957—962; cf. A., 1937, I, 293).—A discussion of current theories. F. L. U.

Theory of the fission rules on the basis of alternations of bond strength, electron density, and spin. O. SCHMIDT (Z. Elektrochem., 1937, **43**, 853—858).—Considerations of the distribution of electron density and spin in chains of atoms having one, two, and three electrons lead to an interpretation of observed results on the splitting of hydrocarbon chains (cf. A., 1936, 1228). F. J. G.

Anisotropy of van der Waals forces. J. H. DE BOER and G. HELLER (Physica, 1937, **4**, 1045—1057).—Mol. orientation by van der Waals forces is determined by (1) an additive effect whereby each mol. tends to surround itself closely with as many neighbours as possible and (2) anisotropy of the polarisability, in consequence of which the polar axes of the mols. tend to be collinear with the direction of attraction. An attempt is made to calculate the relative magnitude of the two effects, and it is inferred that an approach to a collinear orientation is to be expected only with diat. mols. or mols. of high polarisability. F. L. U.

London–van der Waals attraction between spherical particles. H. C. HAMAKER (Physica, 1937, **4**, 1058—1072).—Mathematical. The interaction between two spherical particles is computed. It is shown that when both are immersed in a liquid the London–van der Waals forces should generally give rise to an attraction. F. L. U.

Method for distinguishing between different contributions to van der Waals forces. A. J. STAVERMAN (Physica, 1937, **4**, 1141—1154; cf. A., 1937, I, 507).—A general method is given for dis-

tinguishing the contributions of dispersion, induction, and orientation to the total cohesive forces. F. L. U.

Cohesive forces of liquids with simple molecules and the so-called law of Stefan. A. T. VAN URK (Physica, 1937, **4**, 1025—1033).—It is shown both experimentally and theoretically that the work required to transfer a mol. from the interior of a liquid to the surface is $\not>\frac{1}{4}$ of its internal heat of vaporisation, except for H_2, for which the ratio is 0·4. F. L. U.

Molecular interactions and their influence on polarisability. A. MICHELS, J. DE BOER, and A. BIJL (Physica, 1937, **4**, 981—994).—Mathematical. F. L. U.

Parachor of NO_3F. D. G. HILL and L. A. BIGELOW (J. Amer. Chem. Soc., 1937, **59**, 2127—2128).—The surface tension of NO_3F is $21{\cdot}5\pm0{\cdot}2$ dynes per cm. at $-64{\cdot}1°$ and $23{\cdot}4\pm0{\cdot}2$ at $-80{\cdot}4°$; the calc. parachor is 111. The structure of NO_3F is discussed. E. S. H.

Twenty-fifth anniversary of the Laue diagram. F. LAVES (Naturwiss., 1937, **25**, 705—708, 721—733).—A review dealing with the theory and applications of the *X*-ray interference method. Particular reference is made to the determination of ionic and at. radii in crystals, and its dependence on the type of binding. A. J. M.

Theory of the use of more than two successive *X*-ray crystal reflexions to obtain increased resolving power. J. W. M. DUMOND (Physical Rev., 1937, [ii], **52**, 872—883).—The extended scope discussed may bring the study of the asymmetric diffraction patterns predicted by the theory of Prins within the range of experimental investigation. N. M. B.

Generalisation of the notation for the double-crystal *X*-ray spectrometer. S. K. ALLISON (Physical Rev., 1937, [ii], **52**, 884—885).—A discussion of the Allison–Williams notation and a comparison with that of DuMond (cf. preceding abstract). N. M. B.

Structure of thin oriented metal films deposited by vaporisation. O. RÜDIGER (Ann. Physik, 1937, [v], **30**, 505—526: cf. Brück, A., 1936, 784).—The structure of films of Ag, Au, and Pd deposited by vaporisation on mica, calcite, fluorite, natural quartz surfaces, and polished quartz and Cu is described. For each metal–surface pair a characteristic temp. was observed above which the films were oriented. Orientation is at first confined to the surface but at higher temp. extends throughout the layer. Complete orientation was never observed on quartz surfaces. O. D. S.

***X*-Ray study of the crystallisation of vitreous selenium.** J. A. PRINS and W. DEKEYSER (Physica, 1937, **4**, 900—908).—Amorphous Se, stretched at 60—70°, shows a fibre diagram in transmission, the fibre axis being the hexagonal axis. In reflexion photographs this appears only after tempering above 73°. The results are discussed in respect to the theory of a continuous transition from the glassy to the cryst. state. K. S.

Grain orientation in rolled magnesium alloys. J. C. MCDONALD (Physical Rev., 1937, [ii], **52**, 886—887).—Simple preferred orientation independent of the element added or of the treatment is found for additions up to 4%. Addition of traces of Ca to these alloys or to Mg causes double orientation, which, unlike the case of Zn, cannot be due to twinning but appears to be associated with the reported presence of insol. Mg_2Ca. N. M. B.

Crystal growth in wires of nickel and tungsten. J. A. DARBYSHIRE (Phil. Mag., 1937, [vii], **24**, 1001—1012).—Crystal growth in Ni and W wires used as heaters in valves has been investigated by means of *X*-rays. The chief cause of aggregation in Ni wires is too high a temp. during activation and pumping, followed by slow growth during the life of the heater. Ni–Mg (0·48%) alloy is more brittle than pure Ni, but after 1000 hr. running shows no aggregation. W does not begin to aggregate up to 2500°, and exhibits no aggregation during processing with Al_2O_3, activation, ageing, or in continuous life test. Heaters which failed on intermittent life test showed considerable aggregation. F. J. L.

Preferred orientation of the crystallites of electrodeposited hexagonal chromium. W. A. WOOD (Phil. Mag., 1937, [vii], **24**, 772—776; cf. A., 1931, 1358).—An *X*-ray examination of hexagonal electrodeposited Cr shows that the crystallites tend to lie with the hexagonal axis perpendicular to the plane of the deposit. The same structure persists with the deposit on Cu, Ni, brass, and Fe, cleaned or uncleaned, and appears to be an intrinsic property of Cr. K. S.

Debye–Scherrer diagrams of germanium between 20° and 1100° K. H. NITKA (Physikal. Z., 1937, **38**, 896—901).—Debye–Scherrer diagrams of Ge between 20° and 1100° K. indicate no allotropic transformation within this range, in spite of observed anomalies in resistance, thermo-electric power, sp. heat, and compressibility. The lattice is of the diamond type, like that of grey Sn and Si in the same periodic group. The anomalies are probably due to a transformation of a higher order. A. J. M.

Crystal structure of $CaMg_2$. H. WITTE (Naturwiss., 1937, **25**, 795).—$CaMg_2$ has the same type of crystal structure as $MgZn_2$ ($C14$ type), and occurs in long hexagonal prisms. *X*-Ray diagrams show that Ca takes the place of Mg of $MgZn_2$, and Mg that of the Zn. Lattice consts. are a 6·22, c 10·10 A. Phases with the $MgZn_2$ structure also occur in the system Ca–Ag–Al. A. J. M.

Crystal structure of manganese diselenide and manganese ditelluride. N. ELLIOTT (J. Amer. Chem. Soc., 1937, **59**, 1958—1962).—$MnSe_2$ and $MnTe_2$ have the pyrites type of structure, with a_0 $6{\cdot}417\pm0{\cdot}005$ and $6{\cdot}943\pm0{\cdot}002$ A., respectively, and u $0{\cdot}393\pm0{\cdot}001$ and $0{\cdot}386\pm0{\cdot}002$, respectively. The results suggest that in this type of structure the Mn–X bonds (X = S, Se, or Te) are either ionic or resonate between ionic and covalent types, the latter involving $4d$ orbitals from the Mn atom. The results are supported by the magnetic susceptibilities

of MnS_2, CoS_2, and NiS_2 (A., 1935, 1197), which indicate that Co and Ni probably form d^2sp^3 bonds in these compounds. J. W. S.

Crystal structure of compounds of the rare earths with metalloids of the fifth group. IV. Compounds of neodymium. A. IANDELLI and E. BOTTI (Atti R. Accad. Lincei, 1937, [vi], **25**, 638—640; cf. A., 1937, I, 401).—*X*-Ray measurements show that NdN, NdP, NdAs, and NdSb have a NaCl type lattice with a 5·141, 5·826, 5·958, and 6·309 A., respectively. O. J. W.

Metals and alloys. XXIII. Constitution of phosphides, arsenides, antimonides, and bismuthides of lithium, sodium, and potassium. G. BRAUER and E. ZINTL (Z. physikal. Chem., 1937, **B**, **37**, 323—352; cf. A., 1937, I, 296).—Li_3As, α-Li_3Sb, Li_3P, Na_3Bi, Na_3Sb, Na_3As, Na_3P, K_3Bi, K_3Sb, and K_3As all have the same kind of lattice (the "Na_3As type"). The unit cell is hexagonal, and contains 6 alkali-metal atoms (M) and 2 atoms of the other metal (X). The space-group is D^4_{6h}, and the X atoms form a hexagonal spherical packing with the M atoms in the largest interstices. There is also a cubic (β) form of Li_3Sb, which has the same lattice as Li_3Bi. These are all valency compounds and may be regarded as compounds of M' with X''' ions. The radius of the sphere of action of a given anion increases towards a limit with increasing size of the cation. The morphotropic transition of Li_3Br through Na_3As to Li_3N structures seems to agree approx. with the vals. of the radius ratio of the ions. The Na_3As lattice is approx. anti-isomorphous with that of tysonite. Solid solutions of Na_3As in Na_2Se have been obtained. R. C.

Crystal chemistry of nitrates of univalent cations. III. C. FINBAK, O. HASSEL, and L. C. STRØMME (Z. physikal. Chem., 1937, **B**, **37**, 468—471; cf. A., 1937, I, 603).—The crystal structures and geometrical relations of the alkali nitrates are reviewed. The structure of the high-temp. trigonal form of $RbNO_3$ has been determined. R. C.

Crystal structure and the magnetic anisotropy of $CuSO_4,5H_2O$. K. S. KRISHNAN and A. MOOKHERJI (Nature, 1937, **140**, 896—897).—Magnetic data (cf. A., 1937, I, 20) confirm the structure proposed (A., 1934, 1296) from an *X*-ray investigation. L. S. T.

Crystal structure of ammonium trihydrogen paraperiodate, $(NH_4)_2H_3IO_6$. L. HELMHOLZ (J. Amer. Chem. Soc., 1937, **59**, 2036—2039).—The crystal structure of this compound confirms the above formula. The H_3IO_6'' group has an octahedral arrangement of the O atoms around the I atom, probably distorted by H bonds. The I—O distance is 1·93±0·03 A. Each O atom has one O neighbour from other octahedra at 2·60 A. and two O neighbours at 3·02 A. The shorter distance is attributed to the existence of a H-bond. J. W. S.

Crystal structure and cement chemistry. Stereochemistry of crystalline compounds in Portland cements. E. BRANDENBERGER (Schweiz. Arch. angew. Wiss., 1936, **2**, 45—58; Chem. Zentr., 1936, i, 3886—3887).—The 3 CaO mols. in Ca_3 silicate are especially loosely bound and are readily split off by H_2O. The ultimate degradation product is SiO_2. Structural relationships between the silicates and aluminates are discussed. $Ca_3Al_2(OH)_2$ forms cubic crystals (a 12·56 A.; 8 mols. in unit cube; probable space-group O_h^{10}—$Ia3d$). $Ca_3Al_2Si_3O_{12}$ has in its structure a SiO_4–AlO_6 chain, with Ca added as secondary cations. The compound $Sr_3Al_2(OH)_2$ also exists. H. J. E.

Constitution of the poly-acids. J. S. ANDERSON (Nature, 1937, **140**, 850).—A possible structure for 6-poly-acids such as the 6-molybdoperiodates is suggested from consideration of at. radii. Discrepancies between *X*-ray and physico-chemical evidence may be due to hydrolysis in solution. L. S. T.

***X*-Ray diffraction patterns of organic liquids.** S. TANAKA and Z. MURO (Proc. Phys. Math. Soc. Japan, 1935, **17**, 548—555).—Diffraction ring radii and spacings are given for two-component equal-proportion mixtures of a no. of heterocyclic compounds and monosaccharides. The spacings for mixtures lie between those of the pure compounds. Cyclic compounds with long side-chains give diffuse halos and those without long side-chains sharp halos. Chain compounds and compounds with atoms of high at. no. give diffuse halos. Ordinary isomerides are distinguishable, but optical isomerides are not. CH. ABS. (e)

Assignment of indices to *X*-ray fibre diagrams of cellulose derivatives with the fibre period 15 A. J. GUNDERMANN (Z. physikal. Chem., 1937, **B**, **37**, 387—398).—The dimensions of the unit cells have been determined. With one exception, all the *X*-ray diagrams can be assigned to a trigonal or pseudo-trigonal lattice, and probably all have the same space-group, C_3^2 or C_3^3. The structure of these substances is therefore based on an array of threefold screw axes all parallel to the fibre axis. R. C.

Highly polymerised compounds. CLXXI. Microscopic examination of synthetic substances of high mol. wt. H. STAUDINGER, M. STAUDINGER, and E. SAUTER (Z. physikal. Chem., 1937, **B**, **37**, 403—420).—A fibre of eupolyethylene oxide of degree of polymerisation >1000 consists of fibrillæ, but the absence of a line lattice spectrum in the *X*-ray fibre diagram shows the diameter of the fibrillæ to be >100 A.; the existence of finer fibrillæ is precluded by the relatively high mobility of the mols., which would permit thickening. In cellulose under pressure and tension there is defibrillation into submicroscopic or mol. dimensions. Under pressure single crystals of β-polyoxymethylene (I) split up longitudinally into fibrillæ of min. diameter 0·2 μ., without any sign of transverse structure. 60% H_2SO_4 causes slight swelling, followed by defibrillation, the polyoxymethylene chains being attacked laterally by the acid. Aq. NaOH, however, produces periodic transverse striations on the crystals, supposedly due to fission at the terminal OH of the polyoxymethylene dihydrate chains. The similarity in behaviour between (I) and cellulose suggests a similarity in fibre structure, and it is inferred that the

properties of these fibres are a result of their consisting of macromols., and not of a micellar structure. R. C.

What electrons can tell us about metals. C. J. DAVISSON (J. Appl. Physics, 1937, **8**, 391—397). —A review of methods and results. R. C. M.

Irrational interference phenomena on the penetration of small crystals by fast electrons. F. KIRCHNER and O. RÜDIGER (Ann. Physik, 1937, [v], **30**, 609—615; cf. Kirchner and Lassen, A., 1934, 1451).—It is deduced from further experiments that the thin vac.-deposited metallic films which show irrational interference are oriented with cubic planes parallel to the underlayer. Laue's theory (cf. A., 1937, I, 351) is therefore inapplicable. O. D. S.

Irrational interference points. M. VON LAUE (Ann. Physik, 1937, [v], **30**, 616—618).—The deductions of Kirchner and Rüdiger (cf. preceding abstract) are criticised. O. D. S.

Irrational interference points. F. KIRCHNER (Ann. Physik, 1937, [v], **30**, 619—620).—A reply to von Laue (cf. preceding abstract). O. D. S.

Single and multiple scattering of moderately fast cathode rays by metal foil. E. KRUPPKE (Ann. Physik, 1937, [v], **30**, 577—592).—The angular distribution between 0° and 50° of scattered electrons produced from a beam of 40 to 70 kv. velocity by Ni and Al foils, 3 to 10×10^{-6} cm. and 1 to 6×10^{-4} cm. thick, respectively, has been determined. At small thicknesses and high electron speeds vals. agree with the theoretical curve for single scattering calc. from the Rutherford formula. At large thicknesses and low speeds vals. agree with the curve for multiple scattering calc. from the Gauss theory of errors. A correction to Wentzel's criterion for single scattering (cf. Ann. Physik, 1922, [iv], **69**, 341) is made. O. D. S.

Diffraction of β-rays. S. C. CURRAN (Phil. Mag. 1937, [vii], **24**, 953—964).—β-Rays obtained from Ra-$D + E + F$ in equilibrium are diffracted by thin Al and Au foil. The diameter of the (200) diffraction ring is measured with a Geiger counter and is in good agreement with that calc. by the de Broglie relation. Ra-$D + E + F$ gives rise to a continuous β-ray spectrum, with a single intensity max. at $H_\rho = 2100$, and there is no γ-radiation. F. J. L.

Structure of the hydrides of boron. III. Borine carbonyl and borine trimethylammine. S. H. BAUER (J. Amer. Chem. Soc., 1937, **59**, 1804—1812; cf. A., 1937, I, 119, 397).—Electron diffraction measurements on the vapour indicate that in BH_3CO the B, C, and O atoms are arranged linearly, with the H atoms completing the tetrahedron around the B atom. The interat. distances are H—B 1·20, B—C 1·57, and C—O 1·13, all ±0·03 A. In BH_3NMe_3 the distances are B—N 1·62±0·15 A. and N—C 1·53±0·06 A. The electronic structures and the great difference in stability of the compounds are discussed. J. W. S.

Electron diffraction studies of cuprous oxide. L. H. GERMER (Physical Rev., 1937, [ii], **52**, 959—967; cf. A., 1936, 1451).—Abnormal diffraction patterns due mainly to the unusual smoothness of the etched surfaces and to resulting refractive effects are discussed. A new cubic structure of cell edge 8·35 A., produced by HNO_3 or KCN etch, but not by H_2SO_4 or aq. NH_3, is reported. N. M. B.

Interatomic distances of the alkali halide molecules by electron diffraction. L. R. MAXWELL, S. B. HENDRICKS, and V. M. MOSLEY (Physical Rev., 1937, [ii], **52**, 968—972).—Nuclear distances were obtained for the Na, K, Rb, and Cs halides from visual measurements of interference in electron diffraction photographs given by mol. beams when the salts were heated to approx. 1200°. Distances for Na, K, and Rb halides were 10% less, and for Cs halides 14% less, than in the corresponding crystal lattices. N. M. B.

Diffraction of electrons by cadmium iodide. G. I. FINCH and H. WILMAN (Trans. Faraday Soc., 1937, **33**, 1435—1448).—Photographs and measurements of electron diffraction patterns of built-up films of cryst. CdI_2 are given. The *c*-axial length is double that assigned by Bozorth, and is independent of crystal thickness. The electron diffraction intensity distribution agrees with that required by Hassel's at. co-ordinates. Kirchner's explanation of the elliptic banded effects is confirmed and extended. F. L. U.

Molecular structures of boron trimethyl, trifluoride, trichloride, and tribromide. Covalent radius of boron. H. A. LÉVY and L. O. BROCKWAY (J. Amer. Chem. Soc., 1937, **59**, 2085—2092).—Electron-diffraction investigations show that the mols. are planar and have the interat. distances: B—C 1·56±0·02, B—F 1·30±0·02, B—Cl 1·73±0·02, B—Br 1·87±0·02 A. These and other published data confirm the val. 0·89 A. for the single-linking radius of B surrounded by an octet of electrons and 0·79 A. for B with only 6 electrons. E. S. H.

Electron-diffraction investigation of higher aliphatic halides. J. A. A. KETELAAR and K. J. PALMER (J. Amer. Chem. Soc., 1937, **59**, 2470).—Electron-diffraction figures of αω-dibromodecane, -dibromopentane, and -di-iodobutane show only a few diffuse rings and much background. This result is ascribed to the intramol. action of van der Waals forces, which causes the chains to take up bent configurations. E. S. H.

Electron-diffraction investigation of seven chlorobenzenes. L. O. BROCKWAY and K. J. PALMER (J. Amer. Chem. Soc., 1937, **59**, 2181—2189). —The interat. distances in C_6Cl_6, 1 : 3 : 5-$C_6H_3Cl_3$, *o*-, *m*-, and *p*-$C_6H_4Cl_2$, PhCl, and 1 : 2 : 4 : 5-$C_6H_2Cl_4$ have been determined and are discussed. The C—Cl distance decreases to about 1·70 compared with 1·76 A. for chloromethanes and the C—C distance may increase by 0·02 A. E. S. H.

Electron-optical images of vapour streams by the dark field method. H. BOERSCH (Z. Physik, 1937, **107**, 493—496).—The broadening of a stream of CCl_4 vapour injected into a vac. is studied by the dark field method with an electron microscope. L. G. G.

Volume magnetostriction of iron and nickel. J. L. SNOEK (Physica, 1937, **4**, 853—862).—Dilatometric measurements are recorded. K. S.

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Magnetic properties of single crystals of silicon-iron. H. J. WILLIAMS (Physical Rev., 1937, [ii], **52**, 747—751).—The magnetisation curves for the (100), (110), and (111) directions of Fe–3·85% Si single crystals were obtained from specimens cut in the form of hollow parallelograms so that the sides of each specimen were parallel to the tetragonal, digonal, or trigonal axes, respectively, thus avoiding errors due to demagnetising fields. Considerable anisotropy at low magnetisations was found. The (100) specimen after careful annealing showed a max. permeability of $1{\cdot}38 \times 10^6$. Magnetic anisotropy consts. were obtained. N. M. B.

Variation of initial permeability with direction in single crystals of silicon-iron. H. J. WILLIAMS (Physical Rev., 1937, [ii], **52**, 1004—1005).—Permeability–flux density curves for specimens cut as hollow parallelograms to form closed magnetic circuits (no demagnetising factor) were obtained for 5—100 gauss. Extrapolation to zero flux density gives initial permeabilities 6000, 3100, and 1900 for the (100), (110), and (111) directions, respectively, in the approx. ratio 6 : 3 : 2 in agreement with theory. N. M. B.

Diffraction patterns of silicon-iron crystals oscillating magnetostrictionally. G. W. FOX and H. T. HURLEY (Physical Rev., 1937, [ii], **52**, 1077).—Laue photographs for thin Si–Fe strips containing large single crystals when the strips were oscillated magnetostrictionally indicated that magnetostriction oscillation acts similarly to piezoelectric oscillation and gives slightly more intense patterns. N. M. B.

Magnetic properties of some solid solutions. I. Effect of magnetisation at a high temperature and of crystallisation on the course of the thermomagnetic curves. II. Solid solutions of iron oxides. III. Ferrous sulphide and its solid solutions. A. MICHEL (Ann. Chim., 1937, [xi], **8**, 317—342, 343—378, 379—423).—I. Anomalies in the variation of the intensity of magnetisation (*I*) with temp. in α-Fe_2O_3, Ba, Sr, Pb, and Ni ferrites, and pyrrhotine, are discussed. The anomalies consist in general of a sudden increase in *I* on first heating the specimen ("high-temp. magnetisation"), and a large remanent magnetism on cooling. The governing factor in these effects is the magnetic hardness of the specimen, which is affected by heat-treatment. Demagnetisation is caused by heating the specimen to at least 50° below the Curie point. Annealing at high temp. removes the anomalies, but decreases the chemical reactivity of the specimen. The effects are varied by crystallisation of the specimen, and in the case of non-cubic crystals, by their orientation.

II. Variations of the magnetic properties of Fe oxides with the method of prep. are due to the formation of solid solutions involving Fe_3O_4 and α- and γ-Fe_2O_3. γ-Fe_2O_3 is unstable at low temp., giving α-Fe_2O_3; in a vac. it dissociates to Fe_3O_4 and O_2. γ-Fe_2O_3 can, however, be stabilised by addition of ferrites in solid solution. The Curie point of γ-Fe_2O_3, extrapolated from vals. for the stabilised solid solutions, is 675° (α-Fe_2O_3, 675° also). Part of the stabilising ferrite can be removed from solution without immediate change of the Curie point or cryst. parameters. These changes occur on annealing tho specimen. The O_2 pressure of γ-Fe_2O_3 decreases on formation of solid solutions.

III. FeS forms two types of solid solution; the FeS type is formed with metals and low contents of non-metals, and shows a Curie point and weak ferromagnetism; the pyrrhotine type, formed with higher contents of non-metals, is ferromagnetic and exhibits an allotropic change. The Debye–Scherrer diagrams for both types are identical. The magnetic properties and the solubility limits are discussed. A. J. E. W.

Oxide film on aluminium and its photometric test. R. TOMII and Y. MIYAKAWA (J. Electrochem. Assoc. Japan, 1935, **3**, 232—242).—The reflectivity of Al_2O_3 films formed under various conditions was measured with a photo-electric cell. The min. reflectivity was obtained on electrolysis in 2% $H_2C_2O_4$ at 15°, in 1% H_2CrO_4 at 30°, or in 5·5% $Na_2B_4O_7$ at 50°, using c.d. of 8·3, 3·3, and 0·6 ma. per sq. cm., respectively. CH. ABS. (*e*)

Transformations of manganese. H. YOSHISAKI (Sci. Rep. Tôhoku, 1937, [i], **26**, 182—189).—The points of transformation in Mn have been measured by the differential thermal, dilatometric, and buoyancy methods and occur at 706°, 1087°, and 1150°. The m.p. is 1254°. F. J. L.

Thermal transitions in ammonium compounds. H. P. KLUG and W. W. JOHNSON (J. Amer. Chem. Soc., 1937, **59**, 2061—2063).—From heating and cooling curves NH_4 compounds have been shown to have transitions at the following temp.: NH_4Cl $-30{\cdot}54 \pm 0{\cdot}10°$, NH_4Br $-38{\cdot}12 \pm 0{\cdot}10°$, NH_4I $-41{\cdot}65 \pm 0{\cdot}20°$, $(NH_4)_2SO_4$ $-49{\cdot}71 \pm 0{\cdot}20°$, $(NH_4)_3AsO_3$ $-56{\cdot}02 \pm 0{\cdot}01°$, $(NH_4)_2Cr_2O_7$ $-2{\cdot}40 \pm 0{\cdot}20°$, and $NH_4H_2PO_4$ $18{\cdot}9 \pm 2{\cdot}5°$. These transitions are attributable to rotation of the $NH_4^{\cdot}$ ion. The transition of NH_4Br appears to have a fine structure, possibly due to inception of rotation in one axis prior to rotation in the other axes. No transitions are observed with $(NH_4)_2CrO_4$, NH_4 borate, $(NH_4)_2CO_3$, NH_4NO_3, $(NH_4)_2C_2O_4$, $(NH_4)_2S_2O_8$, $(NH_4)_2HPO_4$, or NH_4 tartrate. J. W. S.

Conductivity of gases at high pressures. J. CLAY, G. VAN KLEEF, and M. A. VAN TIJN (Physica, 1937, **4**, 766). K. S.

[Electrical] conductivity of pure gases at high pressures. J. CLAY and G. VAN KLEEF (Proc. K. Akad. Wetensch. Amsterdam, 1937, **40**, 663—667).—Measurements of the ionisation by γ-rays of Ne and Xe at 65—100 atm. pressure are recorded. Using a high potential gradient at these pressures, measurable conductivity was observed in He, Ne, Kr, Xe, and N_2 without γ- or cosmic-ray bombardment, the effect showing a large dependence on temp. At 4000 v. per cm. Xe has conductivity $3{\cdot}2 \times 10^{-18}$ amp. per v. A. J. E. W.

Conductivity of univalent metals. J. BARDEEN (Physical Rev., 1937, [ii], **52**, 688—697).—Mathematical. N. M. B.

(A) Influence of a magnetic field and of temperature on the electrical resistance of gallium single crystals. (B) Change of resistance of

single crystals of gallium in a magnetic field. W. J. DE HAAS and J. W. BLOM (Physica, 1937, **4**, 767—777, 778—790; cf. A., 1934, 588).—(A) A method for distinguishing the two shorter axes in Ga crystals by the increase in resistance in a magnetic field (11,800—22,300 gauss), at temp. between 14° and 273° K., is described. The sp. resistance of gallium at 0° C. is $5{\cdot}27 \times 10^{-5}$ Ω per cm.

(B) The dependence of the resistance increase on field strength (600—22,300 gauss) and temp. (10—80° K.) is given. K. S.

Measurement of the variation of the specific resistance of platinum with the thickness of the wire, as a contribution to the knowledge of mean free paths of conduction electrons. H. REUTER (Ann. Physik, 1937, [v], **30**, 494—504).—The sp. resistance of Pt wires at temp. from −150° to 0° is inversely ∝ the thickness of the wire for thicknesses from 15·7 to 202 μ. Calc. vals. of the resistance at infinite thickness agree with the accepted vals. for Pt. The mean free path of the conduction electrons is calc. from the Nordheim formula for the increase of resistance by limitation of free path in thin wires; at 0° $\lambda_0 = 3{\cdot}7$ μ. Interpretation of the effect on the hypothesis of a badly conducting shell leads to the conclusion that the thickness of the shell is a function of temp. It is, therefore, more probable that such a shell is identical with the region where the free path of the electrons is limited by the proximity of the surface rather than formed by impurities. From the calc. thickness of the shell a mean free path $\lambda_0 = 1{\cdot}62$ μ. is obtained. O. D. S.

Electrical conductivity of single crystals of tungsten at low temperatures in a strong transverse and longitudinal magnetic field. E. JUSTI and H. SCHEFFERS (Physikal. Z., 1937, **38**, 891—896).—Previous work (A., 1936, 1452) on the increase of resistance of single crystals of W in a transverse magnetic field at low temp. has been extended to fields of 35 kilogauss. Under these conditions the magnetic energy of the free electrons is < the thermal energy and the resistance increases to about 10^6 times the ideal resistance without reaching a saturation val. The anisotropy factor is independent of field strength and temp. The longitudinal effect is small, being within the experimental error. The results do not agree with the assumption of a perfectly free, isotropic, electron gas. A. J. M.

Electrical resistance and magnetic susceptibility of palladium wires charged with deuterium. A. SIEVERTS and W. DANZ (Z. physikal. Chem., 1937, **B**, **38**, 61—71).—D increases the resistance of Pd more than H, the max. relative increase being 0·92 for D (for $PdD_{0{\cdot}66}$) and 0·69 for H (for $PdH_{0{\cdot}79}$). The resistance–concn. curve for Pd–D alloys is convex to the concn. axis. Equiv. amounts of D and H depress the magnetic susceptibility of Pd by equal amounts. R. C.

Magnetic behaviour of superconductors carrying a current on transition to the superconducting state. K. STEINER (Physikal. Z., 1937, **38**, 880—887).—The effect of the passage of an electric current through a superconductor on its magnetic properties at the threshold of transition to or from the superconducting state has been investigated for a single crystal of Sn, polycryst. Sn, Zn–Cd, and In. If the current is flowing, a magnetisation of the superconductor occurs before passing into the superconducting state, the magnetisation having the same direction as the field produced by the current. It increases with the current strength, and changes sign when the current is reversed. The direction of the magnetisation is independent of the direction of the resultant field when an external magnetic field is superimposed, and the phenomenon is observed when a compensating field is applied to counteract the field due to the current itself. A. J. M.

Connexion between magnetic induction and superconduction. J. STARK, K. STEINER, and H. SCHOENECK (Physikal. Z., 1937, **38**, 887—891).—The time taken for the occurrence of paramagnetic and diamagnetic induction in two hollow cylinders of polycryst. Sn on transition to the superconducting state has been compared. The magnetic behaviour of normal conductors (single crystal of Au, polycryst. W) was also investigated at temp. <4° K., in order to discover whether the great change in magnetic induction suffered by superconductors is peculiar to this class of substances. No such change was observed with normal conductors. A. J. M.

Threshold values of superconductors of small dimensions. R. B. PONTIUS (Phil. Mag., 1937, [vii], **24**, 787—796; cf. A., 1937, I, 451).—The effect of depth of penetration on the threshold val. of a Pb wire superconductor was examined. K. S.

Superconductors in alternating magnetic fields. D. SHOENBERG (Proc. Camb. Phil. Soc., 1937, **33**, 559—576).—Magnetic properties are studied by measuring the change in self-inductance of a coil when specimens are introduced in the presence of a magnetic field. The method is applied to observe the variations in magnetic properties of a superconductor with the frequency of an applied a.c. field. The effects of size, nature of the specimen, and amplitude of the a.c. field are studied while the specimen is maintained in the transitional or intermediate state. J. A. D.

"Overshoot phenomenon" in superconductivity. A. D. MISENER (Proc. Camb. Phil. Soc., 1937, **33**, 583—585).—The "overshoot phenomenon" described by Silsbee (cf. Scott and Brickwedde, A., 1937, I, 292) is apparently due to local fluctuation of temp. at the surface of their specimen caused by its particular form and mounting. J. A. D.

Superconductivity. F. LONDON (Physical Rev., 1937, [ii], **52**, 886).—A criticism of Wick (cf. A., 1937, I, 606). N. M. B.

Quantum theory of interatomic currents in aromatic compounds. F. LONDON (J. Phys. Radium, 1937, [vii], **8**, 397—409).—Anomalous diamagnetic anisotropy in aromatic compounds may be explained by a system of interat. currents in the mol. It is shown that such currents cannot occur in saturated compounds. C_6H_6, $C_{10}H_8$, anthracene, Ph_2, pyrene, and phenanthrene are considered in

detail, and the calc. vals. of the diamagnetic anisotropy are in accord with experimental vals. A. J. E. W.

Moment and molecular field of ferromagnetics. L. NÉEL (Ann. Physique, 1937, [xi], **8**, 237—308; cf. A., 1936, 420, 555, 668, 671, 1188).—A comprehensive presentation of a general theory of vol. anomalies, variation of interaction energy with distance between atoms, variation of molecular field with temp., and the differences of ferromagnetic and paramagnetic moments of metals and alloys. Calc. results are in good agreement with available experimental data. N. M. B.

Dia- and para-magnetism of metallic mixed crystals. V. Behaviour of dissolved cobalt and rhodium. E. HILDEBRAND (Ann. Physik, 1937, [v], **30**, 593—608; cf. Vogt, A., 1937, I, 352).—The susceptibility from −190° to 640° of the following series of mixed crystals has been measured: Au–Co from 0·3 to 3·4 at.-% Co, Cu–Co from 0·1 to 0·5 at.-% Co, and Pt–Rh from 9 to 32 at.-% Rh. Susceptibilities are calc. assuming that those of the two components are additive. Weiss' law is obeyed for Co in all cases. The magnetic moment of Co is independent of concn. but differs for the two solvents: Au–Co μ_B, 4·6, Θ, between −160° and −250°; Cu–Co μ_B, 5·4, Θ, between −860° and −1020°. A max. of susceptibility was observed in the Pt–Rh series at 25 at.-% Rh and is interpreted. Up to 25 at.-% Rh, Pt behaves as a neutral ground metal. Weiss' law is obeyed for Rh only at the lowest concn. and vals. μ_B, 1·9, Θ, −90° are obtained. The solubilities of Co in Au and Cu below 500° are <0·37 and 0·12% by wt., respectively, and < previously recorded vals. O. D. S.

Atomic susceptibility of bivalent copper. S. S. BHATNAGAR, H. LESSHEIM, and M. L. KHANNA (J. Indian Chem. Soc., 1937, **14**, 445—448).—The susceptibility of several $Cu^{\cdot\cdot}$ compounds has been determined. The results show that there is no difference in the magnetic state of the Cu atom in simple or complex compounds. E. S. H.

Magnetic properties of vanadium ammonium alum. J. VAN DER HANDEL and A. SIEGERT (Physica, 1937, **4**, 871—878).—Susceptibility measurements varying from 730 to 1909 × 10^{-6} for V NH_4 alum, at temp. between 1·465° and 297·4° K., are described and discussed. K. S.

Magnetic anisotropy of rare-earth sulphates and the asymmetry of their crystalline fields. K. S. KRISHNAN and A. MOOKHERJI (Nature, 1937, **140**, 549).—The vals. given for the magnetic anisotropy of the octahydrated sulphates of Pr, Nd, Sm, and Er do not support the conclusion of Spedding *et al.* (A., 1937, I, 216, 349, 393) that the fields acting on the $M^{\cdot\cdot\cdot}$ ions in these crystals are cubic in symmetry. L. S. T.

Magnetic susceptibility of the CH_2 group in combination. J. FARQUHARSON and M. V. C. SASTRI (Trans. Faraday Soc., 1937, **33**, 1472—1474).—The val. of $\chi_{mol.}$ for 'CH_2', calc. from data for saturated fatty acids, is $-11{\cdot}64 \pm 0{\cdot}026 \times 10^{-6}$. F. L. U.

Effect of ring-closure on magnetic susceptibility. J. FARQUHARSON and M. V. C. SASTRI (Trans. Faraday Soc., 1937, **33**, 1474—1478).—From measurements on 3-, 4-, 5-, and 6-membered C rings and the related open-chain compounds, constitutive correcting consts. for the rings are evaluated. These differ from the vals. given by Pascal. The effect of ring closure is a fall in diamagnetism except in the 5-ring. The necessity for correcting consts. is considered to be due to changes in the χ of the C atom in rings of different size. F. L. U.

Permanent thermo-electric currents in metallic conductors and the thermodynamic basis. F. ODONE (Nuovo Cim., 1936, **13**, 11—15; Chem. Zentr., 1936, i, 3800). H. J. E.

Thermomagnetic properties of ferric oxide. R. CHEVALLIER and Z. E. BÉGUI (Bull. Soc. chim., 1937, [v], **4**, 1735—1742).—Pure α-Fe_2O_3, prepared in different ways, has a magnetic susceptibility in the ferromagnetic region (20°) of 20—100 × 10^{-6}, but when traces of alkaline impurities are present the val. may reach 1000—2000 × 10^{-6}. In the paramagnetic region (720°) the susceptibility of 25 specimens of Fe_2O_3 from different sources is approx. 20 × 10^{-6}, independently of the state at low temp. and of the presence of traces of impurities. E. S. H.

Determination of the relaxation time for the vibrational energy of carbon dioxide. A. VAN ITTERBEEK and P. MARIËNS (Nature, 1937, **140**, 850—851).—Measurements at 16·6° and −31·0° of the absorption of sound in CO_2 give relaxation times at 1 atm. of 8·3 × 10^{-6} and 13·3 × 10^{-6} sec., respectively (cf. A., 1937, I, 504). Impurities ~ a few parts per 1000 have a marked effect. L. S. T.

Aligning action of sound fields on non-spherical particles. R. POHLMAN (Z. Physik, 1937, **107**, 497—508).—A mathematical analysis of the motion of disc-shaped particles under the influence of stationary supersonic waves. An observable alignment of the particles can be produced only by very weak sound fields. H. C. G.

Periodicity in the appearance of supersonic waves. F. HIEDEMANN and E. SCHREUER (Z. Physik, 1937, **107**, 463—473).—The theories of Nath and of Nomoto regarding the interference phenomena observed when a system of stationary supersonic waves is illuminated with parallel light are discussed in relation to Winkelmann's investigation of an analogous phenomenon with an optical lattice. A diagrammatic illustration of the phenomenon is given. H. C. G.

Ultrasonic interferometry for liquid media. F. E. FOX (Physical Rev., 1937, [ii], **52**, 973—981).—Mathematical. Theory is discussed and measurements with H_2O are reported. N. M. B.

Mechanism of luminescence in liquids under ultrasonic treatment. V. L. LEVSCHIN and S. N. RSHEVKIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 399—404).—The intensity of the luminescence of H_2O and aq. solutions under the action of ultrasonic vibration decreases with rising temp. and disappears at about 50°. Traces of most salts have little

effect, but $NaHCO_3$ causes quenching, as does saturation with CO_2. This is interpreted as confirming that the luminescence is due to formation in the liquid of cavities filled with H_2O vapour, which is excited under the influence of p.d. produced when the liquid is disrupted or the cavities destroyed. The luminescence of hydrazide solutions increases with amplitude of vibration but disappears in very violent vibrations. J. W. S.

Effect of intense sound on metallic melts. I. Preliminary experiments. G. SCHMID and L. EHRET (Z. Elektrochem., 1937, **43**, 869—874).—Apparatus for studying the effect of intense high-frequency sound vibrations on metallic melts is described. Sb, Cd, duralumin, and silumin after solidification while exposed to the vibrations show a marked increase in fineness of structure, with corresponding changes in mechanical properties. Sb solidifies without the usual supercooling; the cooling curves of the other metals are unaffected. The vibrations enable Pb to be dispersed in Al. F. J. G.

M.p. of silicon. F. HOFFMANN and A. SCHULZE (Physikal. Z., 1937, **38**, 901—905).—The m.p. of Si (99·89%) determined by a thermo-electric and by an optical-pyrometric method, is 1410±2°. Commercial Si (98%) melts about 2° lower. A. J. M.

Measurements of the atomic heat of aluminium from 1·1° to 20° K. J. A. KOK and W. H KEESOM (Physica, 1937, **4**, 835—842).—Transition from superconductive to nonsuperconductive state occurs at 1·13° K. The at. heat is given by $C_v = D(419/T) + 0{\cdot}00034847T$ g.-cal./degree mol.; below 1·13° K., C_v increases sharply. K. S.

Phase equilibria in hydrocarbon systems. XX. Isobaric heat capacity of gaseous propane, *n*-butane, *iso*butane, and *n*-pentane. B. H. SAGE, D. C. WEBSTER, and W. N. LACEY (Ind. Eng. Chem., 1937, **29**, 1309—1314; cf. A., 1937, I, 413).—The vals. of C_p for these gases have been determined at 70—340° F. and 760 mm., and the data for zero pressure deduced. J. W. S.

Specific heats of solids due to molecular rotations. T. S. CHANG (Proc. Camb. Phil. Soc., 1937, **33**, 524—533).—Mathematical. The methods recently used in the treatment of the order-disorder transitions in alloys (cf. A., 1935, 1192) are applied to calculate the change in sp. heat due to mol. rotation in solids. Rotation of the mols. occurs above a certain crit. temp., resembling the crit. ordering temp. in alloys, and gives rise to a sudden discontinuity in the val. of the sp. heat. Previous calculations made by Fowler (cf. A., 1935, 683) using the Bragg–Williams type of approximation are now repeated using Bethe's method. The agreement with experiment is still poor. J. A. D.

Transitions in solid mono- and tetra-deuteromethane. Entropy relations of monodeuteromethane CH_3D and of deuterium hydride HD. K. CLUSIUS, L. POPP, and A. FRANK (Physica, 1937, **4**, 1105—1116; cf. A., 1937, 1, 505).—Work previously published is summarised. F. L. U.

Data of state of normal and para-hydrogen from the b.p. to 55° K. E. A. LONG and O. L. I. BROWN (J. Amer. Chem. Soc., 1937, **59**, 1922—1924).—Comparison of the *P*–*V*–*T* relations of normal and *p*-H_2 at 21—56° K. reveals no essential difference in behaviour. J. W. S.

Liquid helium temperatures. I. B.p. of helium. II. Vapour pressure curve of liquid helium. G. SCHMIDT and W. H. KEESOM (Physica, 1937, **4**, 963—970, 971—977).—I. Redetermination of the normal b.p. of He gives 4·216° K. The apparatus is described.

II. New measurements on the v.p. of He between 0 and 76 cm. give temp. slightly higher than those calc. by the formulæ which form the basis of the 1932 temp. scale. A table of differences is given. The λ-point is at $p = 3{\cdot}83$ cm. Hg. $T = 2{\cdot}186°$ K. ±0·002. F. L. U.

Pressure, volume, temperature properties of nitrogen at high density. I. Results obtained with a weight piezometer. II. Piston displacement method. M. BENEDICT (J. Amer. Chem. Soc., 1937, **59**, 2224—2233, 2233—2242).—I. Apparatus and procedure for the gravimetric determination of gas *d* is described. Results are recorded for N_2 at −100° to −183° and 100—1250 atm., and at 0° and 1550 atm. An equation of state, which fits these and other published data, is derived. The Joule–Thomson inversion curve for N_2 has been calc. from the equation of state and found to agree with the experimental curve of Roebuck and Osterberg.

II. The vol. changes of N_2 have been measured by the displacement of a gas-tight piston fitted to a cylinder containing N_2. Sp. vols. have been determined at 980—5800 atm. and from −175° to 200°, with a probable error of 0·24%. An equation of state has been fitted to the data, and derived thermal data have been obtained from it. E. S. H.

Vapour pressure and dissociation of tungsten hexachloride in the gas phase. A. A. VERNON (J. Amer. Chem. Soc., 1937, **59**, 1832—1833).—Over the temp. range 25—150° the v.p. (*p*) of WCl_6 is given by $\log p = 3{\cdot}1 - 1198/T$. The equilibrium consts. at 1087°, 1227°, 1327°, and 1727° indicate that the heat of dissociation is about 9000 g.-cal. per mol. J. W. S.

Vapour tensions of certain substances in the interval 0—50 atm. D. N. TARASENKOV and V. P. AFINOGENOV (J. Phys. Chem. Russ., 1937, **9**, 889—900).—The v.p. of the following substances are determined: H_2O (118—237°, 2—41·7 kg. per sq. cm.), C_6H_6 (91—288°, 1·53—48·2 kg.), EtBr (48—226°, 1·53—49·9 kg.); EtOH (96—220°, 2·13—46·1 kg.) Ph_2O (267—447°; 1·23—17·9 kg.); Ph_2 (260—402°, 1·23—11·4 kg.); $C_{10}H_8$ (233—434°, 1·48—27·1 kg.); $SbCl_3$ (235—480°, 1·53—41·0 kg.; and 72—231°, 1·2—756 mm.); $AlBr_3$ (271—482°, 1·53—19·7 kg.); and $BiCl_3$ (245—446°, 3—750 mm.). E. R.

Symmetrical diethyl sulphite. F. ISHIKAWA and C. TANOBE (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1318—1322).—The v.p. (0—158°) is given by $\log_{10} P$ (mm.) $= -2253{\cdot}92/T + 1{\cdot}75 \log T - 0{\cdot}0017947T + 4{\cdot}272492$. The calc. heats of evapor-

ation are 10,623 g.-cal. at 25° and 10,294 at the b.p. The b.p. is −119·8°. The vals. of Trouton const., Ramsay–Shields const., and parachor are discussed in relation to mol. association. Et_2SO_3 is a normal liquid. E. S. H.

More precise formulation of fundamental concepts of thermodynamics. K. A. PUTILOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 701—714).—It is suggested that thermometry and the theory of the equation of state should be based on the principle that if a body is heated or cooled one or more variables of state in addition to the temp. change. Thermodynamically the only possible forms of energy transfer are heat and work. Work is a macrophysical form of energy transfer, whilst heat is a complex of microphysical processes. A process occurring in an isolated system may be defined as irreversible if any process resulting solely in the restoration of the system to its original state is impossible. The definition of an equilibrium process is discussed. R. C.

Equation of state of gases and critical phenomena. J. E. LENNARD-JONES (Physica, 1937, 4, 941—956).—The potential energy of mols. at a separation r is conveniently represented as the sum of attraction and repulsion terms $\lambda r^{-n} - \mu r^{-m}$. The properties of this function are discussed, and vals. of λ and μ are given for several gases when $n = 12$, $m = 6$. An equation of state for high pressures is derived by classical statistical methods and used to calculate the Boyle temp., b.p., crit. temp., and heat of sublimation of a no. of gases. Appreciable divergence between observed and calc. vals. is found only with the lightest gases, for which agreement is not to be expected. F. L. U.

Quantum theory of the non-ideal gas. II. Behaviour at low temperatures. E. BETH and G. E. UHLENBECK (Physica, 1937, 4, 915—924; cf. A., 1936, 1191).—Mathematical. F. L. U.

General extension of Boltzmann's method to van der Waals gases. L. WALDMANN (Physica, 1937, 4, 1117—1132).—Mathematical. F. L. U.

Statistical mechanics of condensing systems. M. BORN (Physica, 1937, 4, 1034—1044).—Mathematical. The treatment adopted by Mayer and Ackermann (J. Chem. Physics, 1937, 5, 67, 75) is improved and simplified. F. L. U.

Theory of condensation. B. KAHN and G. E. UHLENBECK (Physica, 1937, 4, 1155—1156).—Comments on a paper by Mayer (J. Chem. Physics, 1937, 5, 67). F. L. U.

Thermal conductivity of superconductors in a magnetic field. K. MENDELSSOHN and R. B. PONTIUS (Phil. Mag., 1937, [vii], 24, 777—787).—The change of the thermal conductivity of a superconductor in a transverse magnetic field (4·2 K., 0—1500 gauss) in the case of Pb is similar to the change in the electric conductivity; a Pb–Bi alloy shows a hysteresis effect. K. S.

Researches on heat conduction by rarified gases. III. Thermal accommodation coefficient of helium, neon, and hydrogen at 12—20° K. W. H. KEESOM and G. SCHMIDT (Physica, 1937, 4, 828—834; cf. A., 1937, I, 72).—The thermal accommodation coefficients $a_{1,\infty}$ for He, Ne, and H_2 at 12—20° K. are given. $a_{1,\infty} = 1{\cdot}00$ for $T \ll T_{crit.}$, even when the glass surface is covered with an adsorbed unimol. layer. Knudsen's formula for mol. heat transfer is valid. K. S.

Influence of magnetic fields on the heat conductivity of gases. IV. Investigations on mixtures of oxygen with diamagnetic gases. H. SENFTLEBEN and J. PIETZNER (Ann. Physik, 1937, [v], 30, 541—554; cf. A., 1936, 1191).—The effect of magnetic fields on the heat conductivity of O_2 is decreased by the addition of diamagnetic gases. The effect is approx. $\propto$ the partial pressure of O_2, showing that the influence of magnetic field is effective in collisions both between an O_2 and a diamagnetic gas mol. and between two O_2 mols. The influence of the effective cross-section and of the mol. wt. of the added gas is calc. and for gases of mol. wt. close to that of O_2 agrees with experimental vals. For heavier and lighter gases agreement is obtained when it is assumed that the effect of magnetic field in collision between two O_2 mols. is $>$ that in collision between an O_2 and a diamagnetic gas mol. O. D. S.

Thermal conductivity of pure iron. D. HATTORI (Sci. Rep. Tôhoku, 1937, [i], 26, 190—205).—An apparatus for measuring the thermal conductivity of Fe and steel over a range of temp. is described. The thermal conductivity of Armco steel is measured between 30° and 700° and varies from 0·167 to 0·09 g.-cal. per °C. cm. sec. From these results the most probable val. for the thermal conductivity of pure Fe at 30° is calc. to be 0·172—0·175 g.-cal. per °C. cm. sec. F. J. L.

Accommodation coefficients of the noble gases and the specific heat of tungsten. W. C. MICHELS (Physical Rev., 1937, [ii], 52, 1067—1073).—A semi-classical treatment of the thermal accommodation coeffs. for monat. gases against solid surfaces is developed on the basis of Compton's sp. heat theory. Application to the data of Roberts (cf. A., 1934, 6) is satisfactory if the heats of adsorption of He and Ne on W are taken as 50 and 278 g.-cal. per g.-atom, respectively. The Compton characteristic temp. of W is 148° K., indicating that the excess sp. heat of W above the classical val. is partly due to anharmonic terms in the potential energy of the at. oscillators. N. M. B.

Viscosity of air. W. V. HOUSTON (Physical Rev., 1937, [ii], 52, 751—757).—Using the rotating-cylinder apparatus, remeasurements of η and redetermination of all consts. were made. The val. of η at 22° is $1{\cdot}8243 \pm 0{\cdot}0045$ c.g.s. units; this raises the oil drop val. of e to $4{\cdot}796 \times 10^{-10}$ e.s.u. New corrections are discussed. N. M. B.

Fluorine at low temperatures. V. Viscosity of fluorine gas. E. KANDA (Bull. Chem. Soc. Japan, 1937, 12, 463—468).—By measuring the decrement of the oscillation-rotation of a disc, the η of F_2 has been determined between −186° and 0°, and the vals. have been used to calculate the diameter of the mol., 3·02 A., the mean free path, $9{\cdot}12 \times 10^{-6}$ cm., and the Sutherland const., 129. C. R. H.

Effect of similarity of particles on gas kinetic quantities with application to nuclear spins. O. HALPERN and E. GWATHMEY (Physical Rev., 1937, [ii], **52**, 944—951).—Mathematical. Theory is developed and applied in detail to the determination of the coeff. of η and thermal conductivity of ortho- and para-H_2. In favourable cases (Ne) the nuclear spins of isotopes can be determined from η. N. M. B.

Mobilities of ions in a series of liquid hydrocarbons and their relation to viscosity. I. ADAMCZEWSKI (Ann. Physique, 1937, [xi], **8**, 309—359).—Using an improved high-precision Langevin method, measurements were made of the mobilities of ions formed by *X*-rays in the five hydrocarbons C_5H_{12}—C_9H_{20}. Three types of ion exist in each liquid: two positive, of relative mobility 3 : 1, and one negative of intermediate mobility. The limiting mobilities of the slowest ion in C_9H_{20} and the fastest in C_5H_{12} are $0{\cdot}78 \times 10^{-4}$ and $12{\cdot}01 \times 10^{-4}$, diminishing uniformly with increase of η. An analysis of the variation of mobility u with η gives $u = A\eta^{-3/2}$ where A is a coeff. characteristic of each ion. With the help of Stokes' law this leads to an ionic radius $\propto \sqrt{\eta}$.
N. M. B.

Influence of temperature and specific volume on viscosity of liquids. W. R. VAN WIJK and W. A. SEEDER (Physica, 1937, **4**, 1073—1088).—Experimental formulæ proposed to express the η–0 relation for liquids are discussed theoretically, and it is shown that formulæ in which the temp. is assumed to affect η only by influencing the sp. vol. are applicable to non-configurational liquids, whilst those in which a direct influence is assumed are applicable to liquids possessing internal structure. A formula is given which is applicable to measurements under atm. and higher pressures and which shows the difference between the two classes of liquids. F. L. U.

Experimental development of thermal diffusion. T. L. IBBS (Physica, 1937, **4**, 1133—1140).—A historical summary. F. L. U.

Determination of specific gravity and refractive index of aqueous solutions of β-chloroethyl alcohol. J. MATEJKA and B. JELINEK (J. Chim. phys., 1937, **34**, 611—614).—Data are recorded for the complete range of solutions at 20°. n $\propto$ concn., but a slight deviation from linearity at medium concns. is observed for d. E. S. H.

Specific heats of aqueous solutions of carbamide from 2° to 40° and the apparent molal heat capacity of carbamide. F. T. GUCKER, jun., and F. D. AYRES (J. Amer. Chem. Soc., 1937, **59**, 2152—2155).—Sp. heats are recorded for the range from 0·1M to a nearly saturated solution. The apparent mol. heat capacity changes less with concn. than does that of a 1 : 1 electrolyte. Equations connecting these properties with concn. have been derived.
E. S. H.

Viscosities of solutions of chlorides in certain solvents. F. E. DOLIAN and H. T. BRISCOE (J. Physical Chem., 1937, **41**, 1129—1138).—The increase of η produced by the addition of chlorides to EtOH is in the order: $NiCl_2 > AlCl_3 > CoCl_2 > CuCl_2 > FeCl_3 > CdCl_2 > SnCl_4 > HgCl_2$; the increase is > the corresponding increase in aq. solutions. $AlCl_3$ increases η for EtOH–H_2O mixtures. Vals. of η for EtOH–CCl_4, $HgCl_2$–AcOH, and $SnCl_4$–EtOAc mixtures are recorded and the applicability of the equation of Jones and Dole (A., 1929, 1395) is considered.
F. R. G.

Viscosity in concentrated solution. R. HOUWINK (Österr. Chem.-Ztg., 1937, **40**, 472—475).—Formulæ connecting η for viscous solutions with concn. are compared, special reference being made to cellulose nitrate, viscose, rubber, polystyrene, and synthetic resin solutions. J. W. S.

Optical behaviour of dissolved ions and its significance for structure of solutions of electrolytes. VI. Interaction between ions and solvent molecules, and structure of water–alcohol mixtures. G. KORTÜM (Z. physikal. Chem., 1937, **B**, **38**, 1—22; cf. A., 1937, I, 77).—Largely a more detailed account of work already described (*ibid.*, 61). The physical properties of EtOH–H_2O mixtures suggest that at low concns. EtOH is present as a mol. dispersion in H_2O, whilst at higher concns. the degree of dispersity is smaller and mol. swarms of EtOH may be present. R. C.

Electronic structure of alloys. J. C. SLATER (J. Appl. Physics, 1937, **8**, 385—390).—Theoretical. On the assumption that the 3*d* electrons in Fe, Co, and Ni are completely magnetised, the magnetic moments of the respective atoms should be 2·7, 1·7, and 0·6, which correspond with the no. of unfilled spaces in the 3*d* group. The relation is shown to hold also for Ni–Cu, Ni–Zn, Ni–Co, Fe–Ni, Fe–Co, Fe–V, and Fe–Cr alloys. R. C. M.

Alloys of gallium with magnesium. N. A. PUSHIN and O. D. MIĆIĆ (Z. anorg. Chem., 1937, **234**, 229—232).—The system Ga–Mg has been studied by means of cooling curves. There are four *compounds*, $MgGa_2$, MgGa, Mg_2Ga, and Mg_5Ga_2. F. J. G.

Alloys of gallium with aluminium. N. A. PUSHIN and O. D. MIĆIĆ (Z. anorg. Chem., 1937, **234**, 233—234).—The results of Jenckel (A., 1935, 291) have been completely confirmed and the earlier results of Pushin and Stajić (A., 1933, 118) are therefore incorrect. F. J. G.

Solid solutions, their latent energy, and their lattice constant. J. CICHOCKI (J. Phys. Radium, 1937, [vii], **8**, 391—396; cf. A., 1937, I, 138).—Solutions of Zn, Ga, and Ge in Cu, and of Cd, In, Sb, and Sn in Ag, are discussed. The degree of perturbation caused by substitution of a solute atom in the solvent lattice is evaluated using Mott's formula, and the vol. of the solute atom deduced. Formulæ have been derived for the lattice const. and for the "latent energy," from which the m.p. depression can be calc. An analogous treatment of interstitial solute atoms is given; in cases such as Cu–Zn the proportion of such atoms is negligible. A. J. E. W.

Widmanstätten structure. IX. The Mg–Mg_2Sn and Pb–Sb systems. G. DERGE, A. R. KOMMEL and R. F. MEHL (Amer. Inst. Min. Met. Eng. Tech. Publ. 820, 1937, 12 pp.; Met. Tech., 1937, 4, No. 6).—Mg_2Sn with a CaF_2 type of lattice

separates from the close-packed hexagonal Mg matrix with three different orientation relationships: (*a*) [111] ‖ [00·1] and [110] ‖ [10·0]; (*b*) [110] ‖ [00·1] and [110] ‖ [10·0]; (*c*) [111] ‖ [00·1] and [110] ‖ [11·0]. On cooling from 560°, plates form parallel to the [00·1], [10·1], and [10·2] planes of the matrix; quenching and ageing at 250° forms plates on the [00·1] planes only. The different pptn. mechanisms are related to the shearing processes which operate at the heat-treating temp. Rhombohedral Pb ppts. face-centred cubic Pb as plates parallel to the [111] planes of Pb as expressed by the relation [111] Pb ‖ [001] Sb and [110] Pb ‖ [100] Sb. R. B. C.

Constitution of the metallic phases $NaZn_{13}$, KZn_{13}, and KCd_{13}. E. ZINTL and W. HAUCKE (Naturwiss., 1937, **25**, 717).—Extraction of Na–Zn alloys with liquid NH_3 gives $NaZn_{13}$ with cubic structure and *a* 12·27 A. For KZn_{13} and KCd_{13} the vals. of *a* are 12·36 and 13·77 A., respectively. A. J. M.

Mixed crystal series $MgCu_2$–MgNiZn and $MgZn_2$–MgCuAl. W. DÖRING (Metallwirts., 1935, **14**, 918—919; Chem. Zentr., 1936, **i**, 3974).—Cu in $MgCu_2$ and Zn in $MgZn_2$ can be replaced in all proportions by NiZn and CuAl, respectively. Lattice measurements for these mixed crystals are recorded. H. J. E.

Isomorphism of the ternary compounds $Mn_3Zn_3Al_2$ and Mg_4CuAl_6. F. LAVES, K. LÖHBERG and H. WITTE (Metallwirts., 1935, **14**, 793—794; Chem. Zentr., 1936, **i**, 3797).—*X*-Ray and micrographic data are discussed. $Mn_3Zn_3Al_2$ and Mg_4CuAl_6 form cubic face-centred crystals (*a* 14·16± 0·03 and 14·25±0·03 A., respectively; 161 atoms in unit cell in each case). H. J. E.

Dependence on composition of the critical ordering temperature in alloys. C. E. EASTHOPE (Proc. Camb. Phil. Soc., 1937, **33**, 502—517).—Mathematical. The statistical method of Bethe (cf. A., 1935, 1192) is applied to alloys having superlattices of the AB and AB_3 types. It is assumed that at any temp. the alloy is in a single phase. The theoretical relation between the max. val. of the crit. temp. and the composition indicates that for alloys of the AB type, the max. should occur when $[A] = [B]$ as found by experiment. For alloys of the type AB_3 the crit. temp. should have a max. when $[A] > \frac{1}{4}$. This result is not in agreement with experiment. Both results agree, however, with the calculations of Bragg and Williams (cf. A., 1934, 954), who made use of a simplified relationship between the configurational energy and the degree of ordering. J. A. D.

Incomplete solubility of liquid iodine in carbon tetrachloride. J. H. HILDEBRAND (J. Amer. Chem. Soc., 1937, **59**, 2083—2085).—I and CCl_4 form a liquid–liquid system having a crit. solution temp. 160·5°. The relation between the solubilities of I in the solid and liquid states is discussed. E. S. H.

Solubility of cellulose and of its ethers. S. PAPKOV, F. ROGOVIN, and V. KARGIN (J. Phys. Chem. Russ., 1937, **9**, 156—157).—In contact with certain other liquids complete miscibility is found to occur below and above certain temp.; between these the miscibility is limited and two layers are formed. E. R.

Solubility in ternary systems. J. S. KAZARNOVSKI (J. Phys. Chem. Russ., 1937, **9**, 25—31).—The solubility of a non-volatile component in a mixture of two volatile solvents has been calc. for the system $NaCl + H_2O + NH_3$. E. R.

Fluorine at low temperatures. III. Dissolution of chlorine in liquid fluorine. S. AOYAMA and E. KANDA. **IV. Separation of fluorine from oxygen by adsorption and rectification.** E. KANDA (Bull. Chem. Soc. Japan, 1937, **12**, 455—457, 458—462).—III. A saturated solution of Cl_2 in liquid F_2 at −195° contains 1·04% Cl_2.

IV. O_2 is adsorbed by C in greater quantity than F_2. After five adsorptions at −180° a mixture containing 96% F_2 and 3·7% O_2 was refined to 99·4% F_2 and 0·4% O_2. Rectification of liquid mixtures of F_2 and O_2 yielded a liquid containing 99% F_2. C. R. H.

Theory of diffusion in solids. J. E. DORN and O. E. HARDER (Amer. Inst. Min. Met. Eng., Tech. Publ. 836, 1937, 19 pp.; Met. Tech., 1937, **4**, No. 6).—A theory of diffusion in metals is developed which takes account of the lattice structure. It affords an interpretation of the relations between the energy of loosening of an atom and the m.p. and of diffusibility and solubility. Equations relating to interstitial and substitutional diffusion are given. Applications of the theory are discussed. R. B. C.

Statistics of hydrogen–palladium system. J. R. LACHER (Proc. Camb. Phil. Soc., 1937, **33**, 518—523).—Theoretical. The statistical theory of Peierls and Bethe is applied to solutions of H_2 in Pd. The dissociation of H_2 mols. and the existence of excited vibrational states of the absorbed atoms are taken into account. The results are compared with previous calculations in which the Bragg–Williams type of approximation was used. The theoretical isotherms at 160° and 295° are compared with experimental data. J. A. D.

Solubility of deuterium and hydrogen in solid palladium. III. A. SIEVERTS and W. DANZ (Z. physikal. Chem., 1937, **B**, **38**, 46—60; cf. A., 1937, I, 75).—The isobars for the solubility of D_2 and H_2 in Pd-black at 20—350° and 740 mm. and the isotherms at 80—300° up to 1150 mm. have been determined. The curves for the two gases are similar in form, and within certain limits the solubility $\propto$ (pressure)$^{\frac{1}{2}}$. The ratio (n) of the solubility of D_2 to that of H_2 under the same conditions is always <1, the val. at room temp. being 0·96 and at 200° 0·60. In the system Pd–H_2 the transition from the α-phase, which dissolves H_2 and D_2 only sparingly, to the β-phase, which takes up much more H_2 and D_2, occurs on the isobars at higher temp. and on the isotherms at lower pressures than in the system Pd–D_2. From an equimol. mixture of H_2 and D_2 at 100° under 1 atm. Pd sorbs H_2 preferentially. R. C.

Manganese and hydrogen. A. SIEVERTS and H. MORITZ (Z. physikal. Chem., 1937, **180**, 249—263).—The solubility, *s*, of H_2 in Mn, which has been

measured at 20—1320° at pressures, p, up to 1 atm., is $\gg$ that in Cr, Fe, Ni, or Co. The solubility isobar for 760 mm. shows the existence of three transition points for solid Mn (cf. A., 1936, 1455). At a given temp. s for α- or β-Mn $\propto \sqrt{p}$. The temp. coeffs. of s for β-, β′-, γ-, and molten Mn are positive, but the solubility curve for α-Mn has a min. At the m.p. s for molten Mn is $\gg$ for the solid γ-phase. R. C.

Solubility of noble metals and high pressure. II. Dissolution of gold in cyanides at high air pressures. III. Influence of temperature and concentration of potassium cyanide on the rate of dissolution of gold at high air pressures. V. G. Tronev and S. M. Bondin (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 281—284, 313—316).—II. The rate of dissolution of Au in aq. KCN increases with increasing pressure of air up to 50 atm., but is not affected by further increases at 18°. At 50° the rate of dissolution increases steadily up to 70 atm. In N_2 the rate is very small and almost independent of pressure. The results indicate that there is an optimal $[O_2]$ below which diffusion of O_2 is the controlling factor.

III. At high pressures (50 atm.) there is a sufficient $[O_2]$ to eliminate effects due to variation of this factor and under these conditions the rate of dissolution increases continuously with rising temp. The effect of varying [KCN] is the same as at 1 atm. F. J. G.

Solubilities of cupric sulphate and strontium chloride in deuterium water. F. T. Miles and A. W. C. Menzies (J. Amer. Chem. Soc., 1937, **59**, 2392—2395).—Solubility data for $CuSO_4$ at 2·7—110° and for $SrCl_2$ at 0—145° in 98·1% D_2O are recorded. The transition points $CuSO_4,5D_2O \rightarrow CuSO_4,3D_2O$ 96·2±0·2°, $SrCl_2,6D_2O \rightarrow SrCl_2,2D_2O$ 56·4±0·2°, and $SrCl_2,2D_2O \rightarrow SrCl_2,D_2O$ 128·5±0·5° have been determined and compared with the vals. for the corresponding hydrates. E. S. H.

Composition of the liquid phase in aqueous systems containing strong electrolytes of higher valency types as solid phases. G. Åkerlof (J. Physical Chem., 1937, **41**, 1053—1076).—Solubilities at 25° are recorded for $Ba(NO_3)_2$–NaBr, –$BaBr_2$, –$BaCl_2$, –$Ba(OH)_2$, –$FeCl_3$, –$NaNO_3$, –$Al(NO_3)_3$, and –$Th(NO_3)_4$, $NaNO_3$–$Al(NO_3)_3$, KCl–$FeCl_3$, and $K_3Fe(CN)_6$–KCl. The composition of these and a no. of other systems can be expressed by the author's equation (A., 1934, 490). F. R. G.

Solubility curves of the systems carbon tetrachloride–*n*-alkyl acids–water at 25°. H. A. Smith and M. Berman (J. Amer. Chem. Soc., 1937, **59**, 2390—2391).—Solubility data are recorded for the ternary systems involving straight-chain acids with 1—7 C. With increasing chain length the mutual solubility increases at first, but later decreases. The max. occurs with $EtCO_2H$. E. S. H.

Salting-out of molecular benzoic acid in aqueous salt solutions at 35°. G. M. Goeller and A. Osol (J. Amer. Chem. Soc., 1937, **59**, 2132—2134).—The solubility of BzOH in aq. LiCl, NaCl, NaBr, KCl, KBr, NaI, KI, and $BaCl_2$ has been determined, and the mol. solubility and salting-out const. have been calc. for each concn. of salt. The vals. are compared with published data for 25° and 18°. E. S. H.

Salting-out by complex cobalt salts. P. P. Kozakevitsch and R. S. Jankelevitsch (J. Phys. Chem. Russ., 1937, **9**, 113—122).—The salting-out effect of complex Co ions was investigated by measuring their influence on the miscibility of H_2O and PhOH. Increase in the size of the cation by the introduction of neutral mols. into the complex decreases the salting-out capacity, but exchange of NH_3 for H_2O in the complex is without effect. E. R.

Experimental tests of recent theories descriptive of the salting-out effect. P. S. Albright (J. Amer. Chem. Soc., 1937, **59**, 2098—2104).—Dielectric consts. for aq. $COMe_2$, NH_2Ph, Et_2O, glycerol, glycine, and $CO(NH_2)_2$, and d vals. for aq. $COMe_2$, NH_2Ph, glycine, and $CO(NH_2)_2$ have been determined. From the data and the Debye theory of salting-out, the limiting slopes of the solubility curves for the non-electrolyte solutes have been calc. as a function of salt concn. The calc. solubilities agree well with those observed in the more dil. solutions, confirming the essential correctness of the Debye theory. E. S. H.

Periodic structures; Liesegang phenomenon in agar gels. M. F. Taboury and J. Bernuchon (Bull. Soc. chim., 1937, [v], **4**, 1857—1866).—The influence of electrolyte impurities on the formation of Liesegang rings in agar is discussed; the formation of Ag_2CrO_4 rings is favoured by the presence of Br′ and inhibited by SO_4''. The "density" of the rings is independent of $[K_2Cr_2O_7]$ and hardly affected by [KBr] in the gel. The law of Jablczynski relating the distances between successive rings is confirmed. E. S. H.

Periodic structures; Liesegang phenomenon in starch paste. M. F. Taboury and L. Tournat (Bull. Soc. chim., 1937, [v], **4**, 1866—1876).—Ag_2CrO_4 rings are not formed when $AgNO_3$ diffuses into starch paste containing $K_2Cr_2O_7$, but rings appear when KBr is added to the gel. Periodic structures are produced when $CuSO_4$ diffuses into starch paste containing K_2CrO_4. The law of Jablczynski does not appear to be valid in this case. White light and the presence of PO_4''' inhibit the formation of the structures. E. S. H.

Periodic structures; Liesegang phenomenon in agar. Action of light. M. F. Taboury and M. Bellot (Bull. Soc. chim., 1937, [v], **4**, 1876—1884).—When the gel containing $K_2Cr_2O_7$ and KBr is illuminated with light from an electric lamp for a short time before causing $AgNO_3$ to diffuse into the gel in the dark, the formation of rings is favoured; when the illumination is prolonged the formation of rings is inhibited. E. S. H.

Periodic formation of layers in the crystallisation of aqueous solutions of nickel sulphate, cupric chloride and sulphate. P. F. Michalev (J. Phys. Chem. Russ., 1937, **9**, 157). E. R.

Periodic crystallisation of copper sulphate on filter-paper. P. F. Michalev (J. Phys. Chem. Russ., 1937, **9**, 159). E. R.

Adsorption of hydrogen by supported nickel poisoned with carbon monoxide. C. W. GRIFFIN (J. Amer. Chem. Soc., 1937, **59**, 2431—2434).—Adsorption measurements at 0° show that very small amounts of CO cause increased adsorption of H_2. With larger amounts of CO a small low-pressure increase in H_2 adsorption is found, although at higher pressures there is a considerable decrease. Larger amounts of CO decrease the rate of adsorption. It is probable that some, but not all, of the active Ni centres are able to adsorb H_2 as a second layer above the CO. E. S. H.

Activated adsorption of oxygen by molybdenum films. J. H. DE BOER and H. H. KRAAK (Rec. trav. chim., 1937, **56**, 1103—1110).—The oxidation of Mo has been followed by measuring the change in electrical resistance of a film of Mo (which has adsorbed O_2 at −185°) when the temp. is raised in vac. In the series Cs, Mo, C, the activation energy of oxidation increases as the interat. distance decreases. E. S. H.

Gas adsorption in electric fields. O. BLÜH (Z. Physik, 1937, **107**, 369—381).—Mixtures of H_2 + CO_2 and H_2 + SO_2 in approx. equal proportions were streamed slowly through a vessel containing an Al multi-plate condenser across which fields up to 22,000 v. per cm. were established. The relative concn. of H_2 in the gas mixtures before and after streaming were measured simultaneously by means of a differential catharometer. It is shown that unimol. layers of CO_2 and SO_2 are formed on Al and adsorption is not selective to dipolar and quadrupolar mols. L. G. G.

Adsorptive properties of silica gels in relation to their porosity. M. V. POLJAKOV, L. P. KULESCHOVA, and I. E. NEIMARK (J. Phys. Chem. Russ., 1937, **9**, 100—112).—Gels have been prepared by drying in air, C_6H_6, PhMe, and xylene atm. The adsorption of org. vapours during the formation of the gel determines the character of its porosity. The smallest pores are obtained by drying at the higher temp. E. R.

Adsorption of chain molecules. E. BRODA and H. MARK (Z. physikal. Chem., 1937, **180**, 392—402).—The dependence of adsorption equilibria on the chain length of the adsorbed mols. is discussed on the basis of both the kinetic and quantum-mechanical theories. The determining factor is the change in phase vol. caused by a reduction in the no. of degrees of freedom; the heats of adsorption and the consequent effects of temp. change are deduced. J. W. S.

Reversible and irreversible phenomena in the adsorption of vapours by surfaces of salts exposed to vapours. C. J. DIPPEL (Chem. Weekblad, 1937, **34**, 676—677; cf. A., 1933, 457).—The author's work on the adsorption of Cs and I by CaF_2 is reviewed and discussed. D. R. D.

Adsorption of oleic acid and sodium oleate in flotation of heavy spar. W. PETERSEN (Kolloid-Z., 1937, **81**, 212—222).—The adsorption of oleic acid (I) by the solids during froth flotation of $BaSO_4$ has been studied by determining separately the effect on the γ of H_2O, pulp, and froth. There is complete parallelism between the quantity of (I) adsorbed by the concentrate and the % of $BaSO_4$ floated. For a given amount (I) added to H_2O, the lowering of γ is greatest when the degree of dispersion is highest, and when solid is present the adsorbed quantity is a max. under these conditions. The highest efficiency was shown by emulsions of (I) in H_2O produced by ultrasonic waves, and by pouring a 1% solution in EtOH into H_2O. 10 and 50% solutions gave coarser emulsions, and the lowest efficiency was shown by the last-named and by an emulsion made by ordinary mechanical mixing. Similar results were obtained with 1% solutions of Na oleate when these were <2 days old. F. L. U.

Adsorption and wettability of solid surfaces. D. H. BANGHAM and R. I. RAZOUK (Trans. Faraday Soc., 1937, **33**, 1459—1463).—The work done when a solid and liquid are pulled apart is largely determined by the properties of the adsorbed phase formed from the saturated vapour, and hence is to be distinguished from the "work of adhesion" as commonly understood. The heat of immersional wetting is given by $F_L - T^{dF_L/dT}$ (F_L = lowering of surface energy on immersion) and is to be distinguished from the total heat of adsorption at saturation. F. L. U.

Method of capillary analysis for following the adsorption of surface-active substances by the particles of a hydrosol. A. BOUTARIC and (MLLE.) G. BELLOT (Bull. Soc. chim., 1937, [v], **4**, 1899—1907).—The adsorption of saponin by the particles of sols of As_2S_3, $Fe(OH)_3$, and clay, respectively, has been studied by measuring the change of surface tension with time. The influence of concn. and size of the particles in As_2S_3 sols has been examined. Even after flocculation a progressive decrease of adsorbent power for a period of about 15 days is observed; this seems to be connected with a progressive increase in size of the flocculated particles. The masses of As_2S_3, $Fe(OH)_3$, and clay particles required for the adsorption of 1 g. of saponin under the experimental conditions, and the masses of As_2S_3 and clay particles required for 1 g. of serum-albumin, have been evaluated. E. S. H.

Theory of surface tension of electrolytes. J. W. BELTON (Trans. Faraday Soc., 1937, **33**, 1449—1454; cf. A., 1937, 1, 307).—The no. of non-electrolyte mols. present in the surface layer of a solution containing ions is shown to be related to the permanent moment and, to a smaller extent, to the polarisability of the mols. by an expression which, when substituted for Γ in the Gibbs adsorption equation, yields vals. of $d\gamma/dc$ which are in substantial agreement with experiment for solutions of NaCl and KCl. The theory also accounts for the behaviour of non-aq. salt solutions, and is in qual. agreement with the behaviour of ternary solutions. The relative sizes of Li, Na, and K ions calc. from adsorption data agree with those derived from transport measurements. F. L. U.

Surface tension of aqueous soap solutions as a function of hydrogen-ion (p_H) and salt concentration. I. Sodium laurate and sodium nonoate. F. A. LONG, G. C. NUTTING, and W. D. HAR-

KINS (J. Amer. Chem. Soc., 1937, **59**, 2197—2203).—The surface tension is relatively high in basic and low in neutral aq. Na laurate and nonoate, supporting the view that the long-chain paraffin ions and the oppositely charged ions are adsorbed from strongly basic solutions while the surface-active acid is adsorbed more strongly from slightly basic or neutral solutions. Addition of neutral salts lowers markedly the surface tension, particularly in basic solutions. The effect is related to the concn. of the electrolyte, but not to the ionic strength. E. S. H.

Change of surface tension with time. W. N. BOND and H. O. PULO (Phil. Mag., 1937, [vii], **24**, 864—887).—The surface tension of H_2O and aq. solutions of NaCl, K_2CO_3, soap, thymol, *p*-toluidine, butyl, amyl, *n*-hexyl, and *n*-heptyl alcohols has been measured by means of the moving liquid sheet method and also by the oscillating jet method. For pure liquids γ attains its final state in $<0{\cdot}005$ sec. The surface layer in aq. solutions is initially pure H_2O but ultimately it contains an excess (or deficit) of solute. The rate of change of concn. (and change in γ) is initially infinite but subsequently depends on the rate of diffusion of the solute from inside the liquid to the surface layer. The time for γ to pass halfway to its final val. is obtained and agrees with that obtained from theoretical considerations. F. J. L.

Interfacial tension between an aqueous solution and a solution of sapamine in a hydrocarbon. A. BOUTARIC and (MLLE.) M. BRETON (Bull. Soc. chim., 1937, [v], **4**, 1793—1800).—The influence of the concn. of sapamine (in C_6H_6) and of buffer mixtures (in H_2O) on the interfacial tension between the liquid phases has been determined. This depends on the buffer mixture, but in all cases increases rapidly with rising p_H up to about p_H 7, after which it remains nearly const., with a tendency to decrease. With dil. acids (0·001—0·0001N-HCl, $-H_2SO_4$, or $-HNO_3$) the instantaneous interfacial tension increases with increasing dilution and decreases with time. In a medium of known constitution, the interfacial tension against sapamine in C_6H_6 can be used to calculate the p_H. Reference is made to the influence of ions other than $H^{\cdot}$, especially in biological phenomena. E. S. H.

Stability of a surface of contact between two phases. L. GAY (J. Chim. phys., 1937, **34**, 598—610).—Theoretical. Additions and corrections to a previous theory are made (A., 1936, 1064). E. S. H.

Adsorbed moisture films on the surface of glazed porcelain. F. W. JOHNSON (Phil. Mag., 1937, [vii], **24**, 797—807).—Films giving rise to continuous leakage consist of two components, one represented by an adsorbed and the other by a surface solution. The equilibrium relations are independent of voltage stress and temp. K. S.

Effect of dissolved salts on insoluble monolayers. I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1937, **59**, 2400—2414).—Apparatus and technique for the determination of the adsorption of salts from aq. solution by a surface monolayer of an insol. substance are described. Vals. of η for stearic acid and Ba stearate monolayers on H_2O at varying p_H are recorded; the vals. show progressive changes due to adsorption of impurities. Effects on monoskims of stearic acid due to adsorption from H_2O containing 0·0005 p.p.m. of $Al^{\cdot\cdot\cdot}$ or 0·003 p.p.m. of $Cu^{\cdot\cdot}$ are described. Procedure for the visual observation of the influence of very low concns. of impurities in H_2O on the crumple pattern and crystallised monoskim of stearic acid monolayers are described. Equations for the rate of diffusion of dissolved substances through H_2O to an insol. monolayer on the surface are given, and a method for greatly accelerating the rate of arrival at the surface is described. E. S. H.

Unimolecular layers. D. G. DERVICHIAN (Ann. Physique, 1937, [xi], **8**, 361—466).—The author's results are summarised and compared with those of other investigators. J. W. S.

Monolayers of porphyrins and related compounds. A. E. ALEXANDER (J.C.S., 1937, 1813—1816).—Chlorophyll-*a* (I) and -*b* (II), hæmin, Mg naphthalocyanine, Mg and Fe phthalocyanines, protoporphyrin, bilirubin, mesoporphyrin Me_2 ester, and hæmatoporphyrin (III) have been examined in the form of monolayers on aq. substrates. With the exception of (I), (II), and (III), the compounds appear to form very unstable condensed films with conjugated ring systems vertically oriented and close-packed. (I) and (II) give liquid-expanded films which by increase of pressure are condensed to the close-packed form with the dihydroporphin rings vertically oriented. The (III) mols. lie flat on the surface, forming a vapour-expanded type of film. The data are discussed with reference to the constitutions of the compounds. C. R. H.

Wetting of charcoal and nature of the adsorbed phase formed from saturated vapours. D. H. BANGHAM and R. I. RAZOUK (Trans. Faraday Soc., 1937, **33**, 1463—1472; cf. A., 1935, 29).—Blocks of wood C having a pore vol. of 2·6 c.c. per g., suspended with the pore axes vertical in saturated vapours of H_2O, MeOH, C_6H_6, and CCl_4, adsorb vapour, but do not condense liquid in the pores. When, after this adsorption has occurred, the blocks are lowered so as to touch the liquid, the latter rises at a speed which indicates that the wetting angle is $>0°$ for C_6H_6 and CCl_4, and $\gg 0°$ for MeOH and H_2O, until the pores are filled. Vapour-free C, on the contrary, absorbs liquid MeOH rapidly and violently. It is concluded that films adsorbed from vapour cannot act as condensation nuclei for the bulk liquids. A new derivation of two-dimensional equations of state for adsorbed films on solids is given. F. L. U.

Wetting of filaments by molten metals. M. A. COUNTRYMAN (J. Appl. Physics, 1937, **8**, 432—433).—Ni filaments are wetted perfectly by Ag and Au, and Pt filaments by Al and Cu; Mo filaments are wetted by Al, Ni, and Pt, but not by Ag, Au, or Cu; Ta filaments by Al and Ni, but not by Au, Cu, or Ag, and filaments of W by Al, Ni, and Pt, but not by Ag, Au, or Cu. R. C. M.

Capillary systems. XIX. (4) Permeability of channelled and latticed capillary systems

for liquids and gases. E. MANEGOLD (Kolloid-Z., 1937, **81**, 164—179; cf. A., 1937, I, 612).—The subject is treated systematically and theoretically. F. L. U.

Permeability of the reed membrane. I. Dynamics for non-electrolytes. B. STEHLIK (Coll. Czech. Chem. Comm., 1937, **9**, 434—456).—Chiefly theoretical. The initial rate of passage of solvent through permeable membranes $\propto$ the concn. of the solution; it is also $\propto$ the difference in permeability between solvent and solute. The time for attainment of the max. pressure is independent of the concn. J. S. A.

Diffusion of lithium ions through quartz in an electric field. P. M. HARRIS and C. E. WARING (J. Physical Chem., 1937, **41**, 1077—1085).—Measurable transport of $Li^{\cdot}$ through a quartz diaphragm occurs at 5 to 125 v.; the current is given by $Se^{-W/RT}$, where S is a collision factor and W a work factor which approaches a const. val. at the higher voltages (cf. Jost, A., 1934, 11). F. R. G.

Spreading of insoluble films produced by a soluble substance. K. ARIYAMA (J. Physical Chem., 1937, **41**, 1139—1146).—The spreading rate of H_2O-sol. nigrosine on tap-H_2O is given by $dm/dt = Bm^{1-k/2}$ (m is mass per sq. cm. of the film). The shape of the particle and the shape and surface area of the vessel have an undetermined effect. The solid film formed on alum solutions has a thickness of $6{\cdot}87 \times 10^{-6}$ cm. $\pm$ 10% and $n = 1{\cdot}75$. Films formed on distilled H_2O are less stable and tend to dissolve. F. R. G.

Pressure correction of sedimentation equilibria. C. DRUCKER (Z. physikal. Chem., 1937, **180**, 378—382).—Correction terms are derived for reducing the data for sedimentation equilibria to ordinary pressures. For $HgCl_2$ the correction lies within the limits of experimental error. J. W. S.

Theory of osmotic pressure. A. THIEL (Z. physikal. Chem., 1937, **180**, 314—316).—A reply to Wohl (A., 1937, I, 459). R. C.

Cryoscopic studies of solutions in 1 : 4-dioxan. F. H. GETMAN (Rec. trav. chim., 1937, **56**, 1025—1033).—The f.p. of solutions of various org. compounds, mainly alcohols, in 1 : 4-dioxan have been determined and the corresponding mol. depressions calc. Progressive association of solute with increasing concn. is observed. EtOH and $Bu^{\gamma}OH$ are solvated in dil. and associated in conc. solutions; these solutes, when dissolved in other solvents of higher dielectric const., show no solvation even in dil. solution. The association factors of typical solutes in dioxan vary linearly with the concn. E. S. H.

Molecular solution volumes of optical isomerides. W. H. BANKS (J.C.S., 1937 1857—1858).—The slight differences observed by Patterson and Lamberton (cf. A., 1937, I, 513) between the mol. solution vol. of the isomerides of Bu^{β} tartrate are considered to be of the same order as errors arising from temp. uncertainties. C. R. H.

Viscosity of aqueous solutions of electrolytes. III. Concentration anomalies of specific ionic viscosities. H. TOLLERT (Z. physikal. Chem., 1937, **180**, 383—391; cf. A., 1935, 443; 1936, 27).—The sp. ionic viscosities ($\eta_{sp.}$) of $H^{\cdot}$, $Na^{\cdot}$, $K^{\cdot}$, OH', and Cl' have been calc. for 20° and 25° and for concns. 10^{-4}—1N. $\eta_{sp.}$ for OH' and $H^{\cdot}$ show inflexions between $0{\cdot}5 \times 10^{-2}$N and 2×10^{-2}N, but outside this range it varies linearly with the concn. Other ions also show inflexion points in this range at 20°; these become more pronounced and shift towards lower concn. at 25°. The anomalies are attributed to free H_2O and not to solutes, and it is shown that positive changes in η are anomalous, and negative changes normal. J. W. S.

Dielectric constants of solutions of amphoteric electrolytes. III. Anomalous dispersion in the wave-length range 50—100 cm. H. LINHART (Z. physikal. Chem., 1937, **B**, **38**, 23—45; cf. A., 1935, 166).—In the above λ range the dielectric const., ϵ, of aq. solutions of various amphoteric electrolytes falls with λ, but attains at about 60 cm. a const. val. which is $>$ the ϵ of the solvent. With some, a further decline sets in at a lower λ. An interpretation of the results in terms of Malsch's theory (A., 1937, I, 65) is suggested. According to this the solutions contain groups of zwitterions, which also contain H_2O dipoles, linking them together. In the falling part of the dispersion curve the solvate layer of the zwitterions and the "structure" of the solution are preserved, because the relaxation period of the structure is $<$ that of hydrated groups. At a certain frequency of the alternating field, the movement of the structure around the zwitterion fails to keep pace with the period of the field and the zwitterions now turn freely and the flat part of the dispersion curve is reached. The existence of this flat part is inexplicable if rigid association of the dipoles is assumed. In the subsequent further fall the frequency of the field may be supposed to correspond with the relaxation period of the naked zwitterion. R. C.

Osmotic method for determining particle weight of colloidal solutions. W. OSTWALD (Kolloid-Z., 1937, **81**, 195—199).—Contrary to the opinions of Duclaux and of Dobry, these authors' results (cf. following abstract) are in accord with modern theories of osmotic pressure. Examples are given. F. L. U.

Mol. wt. and viscosity of high polymerides. A. DOBRY (Kolloid-Z., 1937, **81**, 190—195).—A summary of work previously published (A., 1934, 958; 1935, 291, 445, 466; 1936, 28, 1459). F. L. U.

Shape, structure, and solidity of the aggregates of non-spherical colloidal particles. W. HELLER (J. Physical Chem., 1937, **41**, 1041—1052).—Non-spherical Fe_2O_3 particles form oblong aggregates, the degree of regularity decreasing with the rate of coagulation and the no. of primary particles. Changes due to ageing are irregular. F. R. G.

Influence of time and of electrolytes on the viscosity of colloidal solutions of arsenious sulphide. A. BOUTARIC and (MLLE.) S. THÉVENET (Compt. rend., 1937, **205**, 862—863).—η for As_2S_3 sols containing 50—60 g. per litre decreases from the time of prep. to a limiting val., the rate of decrease

at 9—70° increasing with temp. With increasing concn. of electrolyte the limiting val. rises and is reached at lower concn. It also increases with the valency of the cation. For K salts the anion appears to have little influence, except in the case of KOH and K_3PO_4, for which η decreases continuously with increasing concn. owing to dissolution of the micelles. R. S. B.

Double refraction in colloid solutions. H. W. FARWELL (J. Appl. Physics, 1937, 8, 416—417).—Sols of V_2O_5 and benzopurpurin show considerable double refraction between crossed nicols, apparently of the streaming type, caused by convection currents. When the sols are contained in a thermostat, any slight mechanical disturbance sets up double refraction, which persists for a considerable time. R. C. M.

Electrochemistry of platinum sols. II. Nature of the electric conductivity of sols. N. A. BACH and A. A. RAKOV (J. Phys. Chem. Russ., 1937, 9, 18—24).—Sols were prepared by dispersing Pt by an a.c. arc in H_2, O_2, and air, and bubbling the gas through H_2O. The conductivity κ was measured and the contribution κ_s due to the sol (as distinct from that of the intermicellar liquid) was determined by coagulating the sol by freezing. For sols prepared in H_2 κ_s increases with concn., up to 75% of κ. These sols consist of Pt particles and H^+ ions, the latter forming the outer part of the double layer. Conditions are more complicated for sols prepared in O_2. E. R.

Dielectric measurements with hydrophilic colloids. II. Bridge method of measuring dielectric constants of conducting liquids. P. J. DENEKAMP and H. R. KRUYT (Kolloid-Z., 1937, 81, 151—164).—A detailed description is given (cf. A., 1937, I, 615). F. L. U.

Aërosols (dusts, smokes, and mists). W. L. H. MOLL (Kolloid-Z., 1937, 81, 225—234).—A review of recent work.

Applicability of the Mie effect in determining particle size of white aërosols, especially when coarsely dispersed. H. ENGELHARD and H. FRIESS (Kolloid-Z., 1937, 81, 129—143).—The spatial distribution of the light diffracted by spherical non-conducting particles has been measured with fogs of Et_2 sebacate and $(C_6H_4Me)_3PO_4$ containing particles of known size. The results are compared with those calc. according to Mie's theory for spheres with radius 70—1400 mμ. The Mie effect can be usefully employed to determine particle sizes between the limits 50 and 500—600 mμ., but the diffraction curves give no information about the degree of heterogeneity of the aërosols. F. L. U.

Disperse gases. III. Bubble size and time of ascent. W. LUCHSINGER (Kolloid-Z., 1937, 81, 180—182; cf. A., 1937, I, 460).—The time of ascent of air bubbles through 140 cm. of H_2O decreases with increase of vol. of the bubbles from 0·00018 c.c., and reaches a min. at 0·004 c.c., beyond which it increases slowly and tends to a const. val. (max. size studied = 0·062 c.c.). The diminished rate of ascent of the larger bubbles is associated with marked deformation and a change in the character of the motion. F. L. U.

Stability of foams. I. Kinetics of the syneresis of foams. K. N. ARBUZOV and B. N. GREBENSCHTSCHIKOV (J. Phys. Chem. Russ., 1937, 9, 32—42).—Foams have been prepared by filtering saponin sol through a Schott filter, and the velocity of syneresis was determined by measuring the vol. of the liquid formed. E. R.

Influence of ultrasonic waves on colloid solubility. III. Peptisation of carbon in ethyl ether. N. SATA (Kolloid-Z., 1937, 81, 182—187; cf. A., 1937, I, 238).—In attempts to disperse C in H_2O and 10 org. liquids by means of ultrasonic waves, only in Et_2O was a stable suspension obtained. H_2O is necessary, but it is immaterial whether it is contained in the C or the Et_2O. Ostwald's "solid-phase" rule is followed. The quantity of H_2O needed for peptisation corresponds approx. with the solubility of H_2O in Et_2O. F. L. U.

State of cellulose in solution. T. LIESER (Kolloid-Z., 1937, 81, 234—241).—A review.

Study of molecular compounds of cellulose by determining the apparent specific volume and by *X*-ray measurement of the unit cell of swollen cellulose. I. SAKURADA and S. OKAMURA (Kolloid-Z., 1937, 81, 199—208).—An expression is derived relating the wt. of H_2O or aq. solution taken up by 1 g. of cellulose with the experimentally determined d of the swollen cellulose and of the liquid used, and the vol. of the unit cell of the former as found by *X*-ray measurements. These quantities have been determined for cellulose swollen in H_2O, aq. NaOH, N_2H_4, HNO_3, and $HClO_4$, and the following compositions are deduced:

H_2O-cellulose (cf. A., 1937, I, 80), $C_6H_{10}O_5,H_2O$;
Na-cellulose-I, $C_6H_{10}O_5,NaOH,3H_2O$;
Na-cellulose-II, $C_6H_{10}O_5,NaOH,H_2O$;
Na-cellulose-IV, $C_6H_{10}O_5,0{\cdot}3NaOH,H_2O$;
hydrazine-cellulose, $C_6H_{10}O_5,N_2H_4,H_2O$;
Knecht's compound, $C_6H_{10}O_5,HNO_3,H_2O$;
perchloric acid cellulose, $2C_6H_{10}O_5,HClO_4,2H_2O$.
F. L. U.

Mechanism of deformation and fine structure of cellulose hydrate. I. Relation between swelling anisotropy and mechanism of deformation in hydrocellulose gels. P. H. HERMANS (Kolloid-Z., 1937, 81, 143—150).—Attention is directed to the importance of measurements of the anisotropy of swelling in affording information about the orientation of cellulose crystallites. Mathematical relations are established between the anisotropy of swelling and the extent of mechanical deformation of an initially isotropic cellulose gel on the assumptions (*a*) that the crystallites are joined end to end and (*b*) that they form a three-dimensional network. Experimental results are in accord with (*b*). F. L. U.

***X*-Ray diffraction patterns of sol, gel, and total rubber when stretched, and when crystallised by freezing and from solutions.** G. L. CLARK, E. WOLTHUIS, and W. H. SMITH (J. Res. Nat. Bur. Stand, 1937, 19, 479—491).—Sol rubber, when stretched at room temp., affords no evidence of the

crystal fibre pattern characteristic of total rubber even at 1000% elongation. Gel rubber shows the pattern at elongations >100%, but exposure to air in the unvulcanised condition and the removal of antioxidants results in the disappearance of crystal interference effects even at 400% elongation. After vulcanisation, sol rubber at elongations >400% and gel rubber at elongations <250% show slight crystal interferences. A large interplanar spacing of 54 A., found in unstretched gel, is absent in the sol. Within experimental error, frozen sol, gel, and total rubbers give rise to similar patterns. The pattern of gel, crystallised from Et_2O, is similar to the patterns of stretched and frozen rubber. Evidence for the cryst. nature of sol deposited from Et_2O has also been obtained. C. R. H.

Isothermal and reversible variation in absorption in thixotropic sols. W. Heller and (Mlle.) G. Quimfe (Compt. rend., 1937, **205**, 857—859; cf. A., 1936, 795).—The variation with time of the absorption coeff. of a goethite sol has been measured for λ 6200 A. at 22·7°. R. S. B.

Soils. XXI. Fixation of silicic radicals by soil clays. J. Clarens and J. Lacroix (Bull. Soc. chim., 1937, [v], **4**, 1916—1920).—When clays are treated with alkaline silicates, a certain amount of SiO_2 is fixed in such a way that it is not removed by subsequent treatment with dil. HCl. The amount fixed is available for the fixation of other bases [*e.g.*, $Ba(OH)_2$] and can thus be determined. E. S. H.

Fluctuations of composition in a system of molecules in chemical equilibrium. F. G. Donnan, E. Teller, and B. Topley (Phil. Mag., 1937, [vii], **24**, 981—1001).—Consideration is given to the fluctuations in an enclosed vol. and in an "open" vol. (small vol. forming part of a larger closed system of the same sort) containing mols. in chemical equilibrium at const. temp. F. J. L.

Degree of ionisation of binary electrolytes and the hydration of their ions. B. H. van Ruyven (Rec. trav. chim., 1937, **56**, 1111—1132).—A crit. review of published work. E. S. H.

Dissociation constants of alkyl-substituted benzoic and phenylacetic acids. J. W. Baker, J. F. J. Dippy, and J. E. Page (J.C.S., 1937, 1774—1779).—Recorded vals. of $K \times 10^5$ at 25° are: *p*-$C_6H_4Et{\cdot}CO_2H$, $4{\cdot}43_5$; *p*-$C_6H_4Pr^{\beta}{\cdot}CO_2H$, 4·43; *p*-$C_6H_4Bu^{\gamma}{\cdot}CO_2H$, 3·98; *p*-$C_6H_4Et{\cdot}CH_2{\cdot}CO_2H$, 4·24; *p*-$C_6H_4Pr^{\beta}{\cdot}CH_2{\cdot}CO_2H$, 4·06; *p*-$C_6H_4Bu^{\gamma}{\cdot}CH_2{\cdot}CO_2H$, $3{\cdot}82_5$. It is suggested that these and earlier data for BzOH, $CH_2Ph{\cdot}CO_2H$, and the *p*-Me-substituted acids are not inconsistent with the postulates regarding the electron-release capacity of alkyl groups and that the small differences in the K vals. may be due to differing heat capacity and entropy effects. On the other hand, the partial inversion found in the benzoic series can, it is thought, be explained on the Baker–Nathan theory. C. R. H.

Determination of dissociation constants of ammonium hydroxide and water from buffer capacity. S. Kilpi (Z. physikal. Chem., 1937, **180**, 464—474).—The dissociation const. of NH_4OH in alkali chloride and NaOAc solutions has been obtained by measuring the buffer capacity. From measurements of the buffer capacity of NH_4OAc solutions, the vals. of the ionic product for H_2O in aq. KCl and NaCl solutions have been derived. R. C.

Physical chemistry of amino-acids, peptides, and related substances. IX. Dissociation constants of amino-acid derivatives. M. Zief and J. T. Edsall (J. Amer. Chem. Soc., 1937, **59**, 2245—2248; cf. A., 1933, 781).—Dissociation consts. have been determined using the formula $pK' = p_H + \log [(a - [H^+])/(b + [H^+])]$, where a is the stoicheiometric concn. of the acidic form of the mol. studied and b that of the conjugate basic form. The vals. obtained for pK' are: hydantoic acid 3·80, glycylglycinehydantoic acid 3·54, acetylglycine 3·60, chloroacetylglycine 3·37, formylglycine 3·42, *N*-carbethoxyglycine 3·65, hydantoin 9·12, 5 : 5-dimethylhydantoin 9·19, glycineamide 7·93, *O*-methyl*iso*carbamide hydrochloride 9·72. The influence of the peptide linking on the dissociation is discussed. E. S. H.

Salt action on the ionisation of acetic acid and hydrolysis of the acetate ion. H. S. Harned and F. C. Hickey (J. Amer. Chem. Soc., 1937, **59**, 2303—2304).—The ionisation of AcOH in aq. LiCl, KCl, and $BaCl_2$ at 25° has been calc. from e.m.f. measurements of the cells $H_2|AcOH(M),MCl_n(m)|AgCl–Ag$. Combining the results with data derived from the cells $H_2|MOH(m_0),MCl_n(m_0)|AgCl–Ag$, the salt effect on the reaction $OAc' + H_2O \rightleftharpoons AcOH + OH'$ has been determined. The concn. term $m_{AcOH}m_{OH}|m_{OAc}$ in the salt solutions has been evaluated; its variation with salt concn. is large in LiCl and $BaCl_2$ solutions. E. S. H.

Ionic activity coefficient product and ionisation of water in uni-univalent halide solutions: a numerical summary. H. S. Harned and M. A. Cook (J. Amer. Chem. Soc., 1937, **59**, 2304—2305).—Equations and numerical parameters relating to H_2O in solutions of K, Na, and Li chlorides and bromides over wide temp. ranges at at. concns. >3M are derived. E. S. H.

Electrolyte action with acetic acid. II. Ionic activity coefficients in aqueous ammonium and alkali chloride solutions. S. Kilpi and A. Meretoja (Z. physikal. Chem., 1937, **180**, 264—280).—Ionic activity coeffs., f, for AcOH in the above solutions at 18° and 25° have been calc. from measurements of H_2 electrode potentials and the dissociation consts. previously determined (A., 1937, I, 516). Interpolation formulæ for the calculation of f have been derived. The activity of undissociated AcOH increases with the salt concn. A solution 0·1N in respect of KCl and AcOH is a convenient reference solution for p_H measurements. R. C.

Thermodynamics of aqueous hydrochloric acid–hydrobromic acid mixtures at constant total molality. B. B. Owen and T. F. Cooke, jun. (J. Amer. Chem. Soc., 1937, **59**, 2277—2279).—The Ag–AgBr electrode gives reproducible results in aq. HBr–HCl over a 7-fold change in relative concn. The activity coeff. of HBr in presence of HCl at 0—45° is given by $-\log \gamma_{HBr|HCl} = \log m + 1/2 \log x + (E - E_0)/2k$, where m is the total molality, E_0 the e.m.f. of the cell containing HBr at unit activity, and $k = 0{\cdot}00019844T$. The rate of variation of

log γ for HCl in the mixtures is of the same order of magnitude, but of opposite sign; its temp. coeff. is also negative. E. S. H.

Thermodynamics of aqueous potassium chloride–lithium chloride mixtures at constant total molalities. B. B. OWEN and T. F. COOKE, jun. (J. Amer. Chem. Soc., 1937, **59**, 2273—2276).—The variation of the v.p. of solutions containing varying amounts of LiCl and KCl at a const. total molality (1, 2, or 3M) has been determined at 25° by the isopiestic method. The osmotic coeff. is a quadratic function of the relative composition. E. S. H.

Thermodynamic properties of solutions of amino-acids and related substances. II. Activity of aliphatic amino-acids in aqueous solution at 25°. P. K. SMITH and E. R. B. SMITH (J. Biol. Chem., 1937, **121**, 607—613; cf. A., 1937, I, 136).—The osmotic and activity coeffs. of *dl*-alanine, *dl*-α-amino-*n*-butyric, *dl*-α-amino-*n*-valeric, and α-amino-*iso*butyric acids, and *dl*-valine have been determined at 25° by an isopiestic method with sucrose as reference substance. J. W. S.

Determination of the activities of electrolytes by the ultracentrifuge. C. DRUCKER (Z. physikal. Chem., 1937, **180**, 359—377).—The sedimentation equilibria in aq. KI, KIO_3, $NaIO_3$, $LiIO_3$, $CsIO_3$, HIO_3, $AgClO_4$, $TlClO_4$, Tl_2SO_4, $CdSO_4$, CdI_2, $KCdI_3$, and $KHgCl_3$ have been determined by the ultracentrifuge method of Pedersen (A., 1934, 1170). The calc. activity gradients are compared with the concn. distribution indicated by e.m.f. and f.p. depression measurements. J. W. S.

Complex formation of ferric ions with chloride ions. M. MOLLER (J. Physical Chem., 1937, **41**, 1123—1128).—It is assumed that aq. $FeCl_3$ contains $[Fe(H_2O)_6]^{\cdots}$ and $[Fe(H_2O)_5Cl]^{\cdot\cdot}$ and from potential measurements at 25° for $Pt|(FeCl_2 + FeCl_3 + HCl)$ against a $KCl–Hg_2Cl_2$ electrode, it is estimated that $[(Fe[H_2O]_5Cl)^{\cdot\cdot}]/[(Fe[H_2O]_6)^{\cdots}][Cl'] = 4{\cdot}1$. F. R. G.

Equilibria in solutions of cadmium and zinc oxalates. W. J. CLAYTON and W. C. VOSBURGH (J. Amer. Chem. Soc., 1937, **59**, 2414—2421).—The solubility products of Cd and Zn oxalates, derived from e.m.f. measurements for the cell $Cd(Ag)|CdC_2O_4$ (sat.), $K_2C_2O_4$,KHC_2O_4, quinhydrone|Pt and the corresponding Zn cell, are $2{\cdot}78 \times 10^{-8}$ and $2{\cdot}47 \times 10^{-9}$, respectively, at 25°. The solubilities of Cd and Zn oxalates in H_2O, in aq. $CdSO_4$ or $ZnSO_4$, and in aq. $K_2C_2O_4$ have been determined at 25°. The ionisation consts. are: CdC_2O_4 $3{\cdot}0 \times 10^{-4}$, ZnC_2O_4 $2{\cdot}1 \times 10^{-5}$ at 25°. The solutions contain only small amounts of $Cd(C_2O_4)_2''$ or $Zn(C_2O_4)_2''$; the instability const. of these complex ions has been calc. E. S. H.

Equilibrium of the semiquinone of phenanthrene-3-sulphonate with its dimeric compound. L. MICHAELIS and E. S. FETCHER, jun. (J. Amer. Chem. Soc., 1937, **59**, 2460—2467).—Equilibrium exists between 4 forms of the dye: (*a*) the oxidised, (*b*) the reduced, (*c*) the intermediate semiquinone radical, (*d*) the intermediate valency-saturated dimeric compound of the radical. The existence of the dimeride is favoured by increasing the total concn. of the dye. In alkaline solution the main intermediate form is the radical, especially at low concns.; in acid solution the radical exists only in extremely small amounts. The dimeric form is scarce when the total concn. of dye is low, but may increase considerably at high concns. Increase of alkalinity increases the total amount of intermediate forms and also the fraction of this which is in the form of a radical. The equilibrium consts. for semiquinone formation, dimeride formation, and dimerisation have been evaluated for acid and alkaline solutions. E. S. H.

Photo-electric extinction measurements on alkaline phenolphthalein solutions. S. BODFORSS and I. LEDEN (Z. anorg. Chem., 1937, **234**, 239—252).—Using apparatus previously described (A., 1935, 722) it is found that Beer's law holds for the red phenolphthalein solutions over a 20-fold range of concn. The kinetics and equilibrium in the reaction $CO_2'·C_6H_4·C(:C_6H_4:O)·C_6H_4·O' + OH' \rightleftharpoons CO_2'·C_6H_4·C(OH)(C_6H_4·O')_2$ have also been studied. Both the velocity coeffs. and the equilibrium const. are markedly influenced by neutral salts, and there is a small sp. influence of the various cations. EtOH shifts the equilibrium to the left. F. J. G.

Transition temperature of gypsum to anhydrite. A. E. HILL (J. Amer. Chem. Soc., 1937, **59**, 2242—2244).—The solubility of $CaSO_4$ in H_2O has been determined at 35°, 45°, and 65°. Comparison with published data for $CaSO_4,2H_2O$ shows that the transition temp. is about 45°. E. S. H.

Thermal dissociation of higher sulphides of tin. J. I. GERASIMOV, E. V. KRUGLOVA, and N. D. ROZENBLUM (J. Gen. Chem. Russ., 1937, **7**, 1520—1524).—SnS_2 dissociates at >650° to form Sn_2S_3, which gives Sn_4S_5 at 700° and SnS at 800°. The so-called intermediate sulphides are in reality solid solutions of the above three sulphides. R. T.

Anhydrous chlorides of chromium. H. A. DOERNER (U.S. Bur. Mines, Tech. Paper 577, 1937, 51 pp.).—The prep. of pure anhyd. $CrCl_2$ and $CrCl_3$ is described. V.p. of $CrCl_2$ and equilibrium concns. in the reaction $CrCl_2 + H_2 = Cr + 2HCl$ have been determined. V.p. and dissociation pressures of $CrCl_3$ are complicated by the formation of $CrCl_4$ (not isolated). Equilibrium concns. for the reaction $2CrCl_3 + Cl_2 = 2CrCl_4$ are given, and employed to calculate partial pressures of $CrCl_3$. All the data are treated thermodynamically, and tables of thermodynamic consts. are given. F. L. U.

Chemical equilibrium between uni- and bivalent copper ions in presence of metallic copper. C. T. KAWASSIADIS (Praktika, 1935, **10**, 391—399; Chem. Zentr., 1936, i, 3988).—Equilibrium data for the reaction $Cu + CuSO_4 = Cu_2SO_4$ at 50—200° in presence of H_2O are recorded. Rise in temp. favours the formation of Cu_2SO_4. H. J. E.

Furfurylidene- and benzylidene-phenol systems and their fusion diagrams. V. V. TSCHELINCEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 347—350; cf. A., 1936, 1241).—Curves are recorded for mixtures of mono- and di-furfurylidene- and -benzylidene-acetone with *o*-, *m*-, and *p*-$C_6H_4(OH)_2$. Maxima occur with colour change at simple mol.

compositions which indicate the new phenol–ketone *complexes*: [X.4*A*], [X.2*A*], [X.2*B*], [X.*B*], [2X.*B*], where X = $C_6H_4(OH)_2$, *A* = R·CH:CH·COMe, *B* = (R·CH:CH)$_2$CO. These org. complexes are explained by quadrivalency in the ketonic O. I. McA.

System lithium sulphate, cadmium sulphate, and water at 30°. H. Parks, M. Patterson, and W. C. Vosburgh (J. Amer. Chem. Soc., 1937, **59**, 2141—2142).—Solubility data are recorded. There is no evidence of the existence of a double salt. E. S. H.

Calcium arsenates. Three-component system calcium oxide–arsenic oxide–water. O. A. Nelson and M. M. Haring (J. Amer. Chem. Soc., 1937, **59**, 2216—2223).—Equilibria at 62° have been determined and the solid phases examined by microscopical and *X*-ray methods. The existence of $CaHAsO_4$, $Ca_5H_2(AsO_4)_4,5H_2O$, $Ca_3(AsO_4)_2,2H_2O$, and $4CaO,As_2O_5,xH_2O$, but not the reported $10CaO,3As_2O_5,4H_2O$, has been established. E. S. H.

Heterogeneous equilibria in aqueous solutions of the sodium salts of the vanadic acids at 30°. S. J. Kiehl and E. J. Manfredo (J. Amer. Chem. Soc., 1937, **59**, 2118—2126).—The system V_2O_5–Na_2O–H_2O at 30° has been studied. The solid phases stable in contact with solution at 30° are: $NaOH,H_2O$, $Na_3VO_4,2{\cdot}5H_2O$, $Na_3VO_4,7H_2O$, $Na_3VO_4,12H_2O$, $Na_4V_2O_5,18H_2O$, $NaVO_3,2H_2O$, $Na_4V_6O_{17},12H_2O$, and V_2O_5. Convenient apparatus for sampling and determining the *d* of a liquid phase is described. E. S. H.

Reciprocal salt-pair $(NH_4)_2SO_4 + 2KCl \rightleftharpoons K_2SO_4 + 2NH_4Cl$ in water and in ammonia–water at 25°. A. E. Hill and C. M. Loucks (J. Amer. Chem. Soc., 1937, **59**, 2094—2098).—Solubility data are recorded. The solid phases are solid solutions of NH_4Cl + >2·5% of KCl, KCl + >16·6% of NH_4Cl, and K_2SO_4 + $(NH_4)_2SO_4$ in all ratios. E. S. H.

Formation of an organic ternary molecular compound. I. System antipyrine–quinol–pyrocatechol. K. Hrynakowski and F. Adamanis (Bull. Soc. chim., 1917, [v], **4**, 1815—1825).—A ternary compound is not formed in this system, although 4 binary compounds have been recognised. The system has 6 eutectic points; the corresponding temp. and compositions have been determined. E. S. H.

Sign and symbol of heat of reaction. H. J. S. Sand (Nature, 1937, **140**, 809—810).—Certain recommendations of the report of the Joint Committee of the Chemical, Faraday, and Physical Societies on symbols and conventions are criticised. L. S. T.

Thermochemistry of perchloric acid and perchlorates. C. F. Goodeve and A. E. L. Marsh (J.C.S., 1937, 1816—1819).—The heat of reaction of Cl_2O_7 with excess of H_2O is −50·0±0·5 kg.-cal. per g.-mol. of Cl_2O_7. There is no evidence for the formation of a stable Cl_2O_7,H_2O. The slow rate of dissolution of Cl_2O_7 in H_2O suggests a limited solubility of $HClO_4$ in Cl_2O_7. From the heats of dissolution and formation of Cl_2O_7, the calc. heat of formation of aq. $HClO_4$ is $-31{\cdot}6_5$ kg.-cal. Calc. heats of formation of cryst. salts are: $NaClO_4$, −93·0; $KClO_4$, −104·4; NH_4ClO_4, −70·2; $Ba(ClO_4)_2$, −194·3 kg.-cal. C. R. H.

Heats of ionisation of water, ammonium hydroxide, carbonic, phosphoric, and sulphuric acids. Variation of ionisation constants with temperature and the entropy change with ionisation. K. S. Pitzer (J. Amer. Chem. Soc., 1937, **59**, 2365—2371).—The recorded heats of ionisation at 25° are: H_2O, $13{,}358 - 50{\cdot}0(t-25) + 0{\cdot}15 \times (t-25)^2$; NH_4OH, 865±30; H_2CO_3, 1843±60; HCO_3', 3500±60; H_3PO_4, −1880±80; H_2PO_4', 800±80; HPO_4'', 3500±500; HSO_4', −5200±500 g.-cal. per mol. Consideration of the changes in heat content, free energy, entropy, and heat capacity with ionisation for 16 weak acids shows that for all first ionisations ΔS^0 is approx. −22 g.-cal. per mol. and ΔC_p approx. −40 g.-cal. per mol. From these generalisations a formula is developed, which gives the approx. ionisation const. over a range of temp. when a single experimental val. is known: $\log K = \text{const.}/T + 53{\cdot}78 - 20 \log T$. If several vals. are available, the form $\log K = A + B/T + 20 \log T$ may be used. E. S. H.

Hydrazine: heats of dissolution of hydrazine and hydrazine hydrate at 25°. V. C. Bushnell, A. M. Hughes, and E. C. Gilbert (J. Amer. Chem. Soc., 1937, **59**, 2142—2144).—Sp. heats of aq. N_2H_4,H_2O at 25° are recorded. The heat of dissolution of N_2H_4,H_2O is −2098 g.-cal.; that of N_2H_4 is −3895 g.-cal. E. S. H.

Thermal data. VII. Heats of combustion of seven amino-acids. H. M. Huffman, S. W. Fox, and E. L. Ellis. **VIII. Heat capacities, entropies, and free energies of amino-acids.** H. M. Huffman and E. L. Ellis (J. Amer. Chem. Soc., 1937, **59**, 2144—2150, 2150—2152; cf. A., 1936, 1341).—VII. Data recorded are: *dl*-alanine 386·55±0·14; *d*-arginine 893·48±0·30, glycine 232·57±0·10, *d*-leucine 856·01±0·21, *l*-leucine 855·98±0·20, *dl*-leucine 855·23±0·21, *l*-tyrosine 1058·34±0·37 kg.-cal. per mol.

VIII. Heat capacities of *dl*-alanine, *d*-arginine, *dl*-leucine, and *l*-tyrosine have been determined over the range 90—298° K. The entropies at 298·1° K. are 31·6, 49·5, 59·9, and 53·0, respectively, and the corresponding free energies are −89,440, −84,610, −58,490, and −97,750 g.-cal. per mol. E. S. H.

Thermodynamics in hydrocarbon research. C. L. Thomas, G. Egloff, and J. C. Morrell (Ind. Eng. Chem., 1937, **29**, 1260—1267).—The differences between thermodynamic data calc. from the heat capacities at low temp. and those calc. from infra-red and Raman spectral data are discussed. From recent data it is deduced that the standard free energies of formation of straight-chain hydrocarbons C_nH_{2n+2} are given by $\Delta G_T^0 = -10{,}550 - 5890n + 25{\cdot}2nT - 2{\cdot}2T$ g.-cal. per mol., when $n > 1$, and those of olefines of the form $C_{n-2}H_{2n-3}{\cdot}CH{:}CH_2$ by $\Delta G_T^0 = 20{,}321 - 5835n - 33{\cdot}26T + 24{\cdot}52nT$ g.-cal. per mol., when $n > 2$. From the latter expression it is inferred that such olefines should be interconvertible in presence of catalysts at 611° K. with zero standard free energy change. Data for 42 hydrocarbons are

recorded and possibilities of reaction at various temp. discussed. J. W. S.

Electrical conductances of standard potassium chloride solutions throughout the temperature range 0—25°. R. W. BREMNER and T. G. THOMPSON (J. Amer. Chem. Soc., 1937, **59**, 2372—2374).—Results for 0·1 and 0·01 "demal" standard KCl solutions at 5°, 10°, 15°, and 20° are recorded. The accuracy is 0·001—0·01%. An equation which fits these and other published data has been derived; it predicts a point of inflexion in each temp.–conductance curve. E. S. H.

Conductivity of hydrochloric and phosphoric acid in presence and absence of hydrogen sulphide. H. JABŁCZYŃSKA-JĘDRZEJEWSKA and J. GROYECKA (Rocz. Chem., 1937, **17**, 392—397).—The conductivity of aq. HCl or H_3PO_4 falls with increasing $[H_2S]$, probably owing to the reaction $H_2S + H^{\cdot} \rightarrow [H_3S]^{\cdot}$. R. T.

Conductance of salts in H_2O–D_2O mixtures. J. P. CHITTUM and V. K. LA MER (J. Amer. Chem. Soc., 1937, **59**, 2425—2430).—Equiv. conductances of approx. 0·02N-LiCl, -NaCl, and -KOAc in H_2O–D_2O mixtures have been determined at 25·0°. The mobilities of the ions in D_2O have been calc. In passing from H_2O to D_2O the transference no. of $Li^{\cdot}$ decreases by about 2%; the other ions are less affected. The influence of η on conductance has been examined. The stoicheiometric dissociation const. of AcOH in D_2O has been derived. The temp. coeff. of equiv. conductance of NaCl solutions in D_2O is $>$ in H_2O at 25—45°. E. S. H.

Effect of viscosity on ionic mobilities. D. BELCHER (Nature, 1937, **140**, 810).—The influence of increasing [PhOH] on the equiv. conductance of 10^{-4}N-HCl at 25° has been determined. For [PhOH] up to 0·3N, the equiv. conductance $\propto$ the relative fluidity of the PhOH solution. The bearing of this result on the interpretation of dissociation consts. is discussed. L. S. T.

Electrochemical behaviour of rhodium. IV. Transport and p_H measurements in hydrochloric acid and aqueous solutions of rhodium trichloride. G. GRUBE and H. AUTENRIETH (Z. Elektrochem., 1937, **43**, 880—886).—On electrolysis of solutions of $RhCl_3$ containing HCl, Rh migrates to the anode, the migration being greatest when there are from two to three mols. of HCl per mol. of $RhCl_3$. These solutions contain complex acids such as H_2RhCl_5 or H_3RhCl_6, but the complex anion is partly dissociated into $Rh^{\cdot\cdot\cdot}$ and Cl'. On evaporation of a solution of $RhCl_3$ in conc. HCl a *compound* $H_2RhCl_5,4H_2O$ is obtained. In aq. solutions of $RhCl_3$ the amount of Rh migrating to the cathode is $\ll$ that which would correspond with simple ionisation. In such a solution a complex acid such as $H_3[RhCl_3(OH)_3]$ is formed, a view which is supported by p_H measurements. In 2·71M-$RhCl_3$ $[H^{\cdot}] = 0·975$N. F. J. G.

Electrochemical study of the ternary system $AlCl_3$–NaCl–$PhNO_2$. A. M. RUBAN (J. Gen. Chem. Russ., 1937, **7**, 1419—1426).—Conductivity in the system increases parallel with [NaCl], whilst with increasing $[AlCl_3]$ it passes through a max. Na is deposited at the cathode. R. T.

Potential of the normal and the decinormal calomel electrodes at temperatures ranging from 12·5° to 91°. H. T. S. BRITTON and G. WELFORD (J.C.S., 1937, 1846—1848).—Data for 12·5°, 25°, 34°, 53°, 63°, 75°, and 91° are recorded. C. R. H.

Temperature coefficient of the standard silver electrode. Entropy of silver ion. J. J. LINGANE and W. D. LARSON (J. Amer. Chem. Soc., 1937, **59**, 2271—2273).—The temp. coeff. of the theoretical cell $Ag|Ag^{\cdot}(a = 1)|H^{\cdot}(a = 1)|H_2(1$ atm.), derived from measurements of the temp. coeffs. of cells of the type $Pt|quinhydrone(s), HClO_4(C_1)|HClO_4(C_1), AgNO_3(C_2)|Ag$ (where $C_1 \gg C_2$), is $+0·967 \pm 0·004$ mv. per degree at 25°. The calc. standard entropy of $Ag^{\cdot}$ at 25° is 16·7 g.-cal. per degree per mol. E. S. H.

Measurement of the molal ferric–ferrous electrode potential. W. C. SCHUMB, M. S. SHERRILL, and S. B. SWEETSER (J. Amer. Chem. Soc., 1937, **59**, 2360—2365).—The molal $Fe^{\cdot\cdot\cdot}$–$Fe^{\cdot\cdot}$ electrode potential, derived from e.m.f. measurements of the cell $Pt,H_2|HClO_4(c_1),|Fe(ClO_4)_3(c_3), HClO_4(c_1), Fe(ClO_4)_2(c_2)|Pt$, is $-0·7701$ v. The formal $Fe^{\cdot\cdot\cdot}$–$Fe^{\cdot\cdot}$ electrode potentials for $Fe(ClO_4)_3$–$Fe(ClO_4)_2$ mixtures in aq. $HClO_4$ for ionic strengths of 0·1 to 1·0 are recorded; over the ionic strength range 0·5—1·0 the val. is $-0·741$ v. A method for the determination of free acid in presence of $Fe^{\cdot\cdot\cdot}$ and $Fe^{\cdot\cdot}$ is described. E. S. H.

Electrode potential of thin films of zinc on platinum. D. P. MELLOR and H. MULHALL (J. Proc. Roy. Soc. New South Wales, 1937, **70**, 332—337).—Experiments have been made to determine the min. thickness of Zn which must be deposited on Pt in order that the electrode may have the same potential as massive Zn. The cell $Zn|ZnSO_4|Pt$ was short-circuited until the e.m.f. fell to 0·05 v. and the amount of Zn deposited was determined. The thickness of the layer is found to depend on the nature of the electrolyte and the rate of deposition of the metal. The results are discussed in relation to the nature of the Pt surface, and the effect of alloying of the Zn with the Pt substrate. A. J. M.

Nature of the glass electrode potential. III. Cause of the asymmetry potential of the glass electrode. H. YOSHIMURA (Bull. Chem. Soc. Japan, 1937, **12**, 443—452).—The asymmetry potential approaches zero when the H_2 electrode functions of both surfaces of the electrode membrane approach each other. With a bulb membrane the electrode function is generally less on the convex than on the concave surface, and the positive pole of the asymmetry potential is generally on the convex side. With increasing thickness of the membrane, the magnitude of the asymmetry potential and the difference between the electrode functions decrease. The subject is discussed mathematically. C. R. H.

Calculation of the normal potential of the non-metal. I. UHARA (J. Physical Chem., 1937, **41**, 1117—1121).—Relative vals. of the normal

potentials of F, Cl, Br, I, and O are deduced by the author's method (A., 1936, 799). F. R. G.

Electromotive behaviour of bismuth elements. T. KURENNIEMI (Ann. Acad. Sci. fenn., 1935, **A, 44**, No. 5, 5—68; Chem. Zentr., 1936, i, 3978).—Measurements for the cell $Bi|Bi_2O_3$ dissolved in $HCl|Hg_2Cl_2|Hg$ and for the corresponding bromide cell are recorded. H. J. E.

Theory of limiting currents. II. Limiting currents of cells without and with an indifferent electrolyte. D. MACGILLAVRY (Rec. trav. chim., 1937, **56**, 1039—1046; cf. A., 1937, I, 620).—Theoretical. Formulæ for the limiting currents of cells with one electrolyte, and for the depression caused by adding an excess of indifferent electrolytes, are derived and compared with published data. The large depression of the limiting currents at the dropping electrode is explained. E. S. H.

Thermo-galvanic cells. D. RĂDULESCU and F. BĂRBULESCU (Bull. Soc. Chim. România, 1936, **18**, 137—150).—Measurements of E for a no. of cells consisting of two identical electrode systems at different temp. show that the solution pressure P in the Nernst equation varies only slightly with temp., but depends to a greater extent on the concn. of the ions in solution. This is considered to be evidence against the view that P may be regarded as an osmotic pressure acting at the electrode surface. Vals. of ρ, η, and κ at 0—80° for M- and 0·1M-$CuSO_4$, -$ZnSO_4$, -$AgNO_3$, -$Co(NO_3)_2$, and -$KAl(SO_4)_2$ are tabulated. A. J. E. W.

Standardisation of some buffer solutions at elevated temperatures. H. T. S. BRITTON and G. WELFORD (J.C.S., 1937, 1848—1852).—p_H vals. at 12·5°, 25°, 34°, 53°, 63°, 75°, and 91° are recorded for the neutralisation of Britton–Robinson universal buffer, and of its constituents, viz., 0·2N-citric acid, 0·2N-KH_2PO_4, 0·2N-HBO_2, and 0·03N-diethylbarbituric acid, by the addition of NaOH. The p_H vals. of the universal buffer vary little with temp. below p_H 6, but higher vals. decrease with rise of temp. C. R. H.

Polarographic studies with dropping mercury cathode. VI. Simultaneous polarisation of both electrodes. V. MAJER (Coll. Czech. Chem. Comm., 1937, **9**, 457—464).—The influence of the electrolyte and of the presence of O_2 on the variations in anodic and cathodic potential accompanying changes in applied voltage are discussed. J. S. A.

Cathodal polarisation in electro-deposition of metals from aqueous solutions. A. LEVIN and O. ESSIN (J. Gen. Chem. Russ., 1937, **7**, 1478—1487).—The potential–c.d. curves for electrolysis of $CuSO_4$ in $HCO{\cdot}NH_2$, or of $AgNO_3$ in C_5H_5N, suggest chemical polarisation, whilst concn. polarisation only is found in the electrolysis of CuCl in $HCO{\cdot}NH_2$ or of $ZnCl_2$ or ZnI_2 in C_5H_5N. R. T.

Cathodic polarisation in the deposition of zinc from zincate solutions. O. ESSIN and T. BEKLEMISCHEVA (J. Phys. Chem. Russ., 1937, **9**, 145—155).—Cathodic potential (E)–c.d. curves have been determined for solutions of ZnO in KOH and a formula derived for the calculation of concn. polarisation η_κ. The sum of the equilibrium potential E_0 and the chemical polarisation (overvoltage) η_X is calc. by subtracting η_κ from E. $E_0 + \eta_X$ changes rapidly with c.d., thus indicating that η_X is $\neq 0$. The overvoltage is of the type explained by slow discharge of ions. E. R.

Polarisation in the deposition of alkali metals on mercury cathodes. O. ESSIN, M. LOSCHKAREV, and K. SOFIJSKI (J. Phys. Chem. Russ., 1937, **9**, 132—144).—Cathode potential–c.d. curves have been determined (*a*) with a Hg-jet electrode, and (*b*) with a stationary Hg electrode and a mixer. In both cases the polarisation is a function of c.d. and the form of this function indicates that the polarisation is due to the slow diffusion of the alkali metal into Hg rather than to the slow discharge of ions. E. R.

Theory of many-electrode electrochemical systems and its application to corrosion problems. II. Three-electrode galvanic systems. N. D. TOMASCHOV (J. Phys. Chem. Russ., 1937, **9**, 43—63).—A Cd electrode was immersed in an electrolyte between a Pt anode and a Zn cathode and connected to various parts of the external circuit. Direction and strength of the current in the intermediate electrode were determined in relation to its position in the liquid, to the resistances of the external circuit on both sides of the branching, and to the conditions of electrolysis. E. R.

The p_H of distilled water, and hydrolysis of ammonium sulphate, nitrate, chloride, and acetate. J. A. CRANSTON and H. F. BROWN (Trans. Faraday Soc., 1937, **33**, 1455—1458; cf. A., 1937, I, 245).—The p_H of pure H_2O has been measured with a glass electrode and the results of Ellis and Kichl (A., 1936, 38) are confirmed. The hydrolysis consts. of NH_4NO_3 and NH_4Cl, calc. from p_H vals. at dilutions from 0·1N, are $1{\cdot}4 \times 10^{-10}$ at 15°. $(NH_4)_2SO_4$ gives higher p_H vals. than the others at corresponding concns. The p_H of NH_4OAc is substantially unchanged by dilution. F. L. U.

Electron affinity of free radicals. XII. ΔF of addition of sodium to organic compounds by the potentiometric and analytical methods. N. B. KEEVIL (J. Amer. Chem. Soc., 1937, **59**, 2104—2107; cf. A., 1936, 1205).—Determinations of the free energy of addition of Na to fluorenone, C_2Ph_4, didiphenylenediphenylethane, and $\alpha\gamma$-bisdiphenylene-β-phenylallyl have been made by the e.m.f. and analytical methods formerly described. Good agreement between the two sets of results is obtained. E. S. H.

Sugar alcohols. IX. Physicochemical study of the erythritan–boric acid complex. J. C. KRANTZ, jun., E. F. BECK, and C. J. CARR (J. Physical Chem., 1937, **41**, 1087—1090; cf. A., 1936, 1463).—Increase of the erythritan : H_3BO_3 ratio diminishes the p_H whilst dilution of the complex has the opposite effect. Change of temp. is without influence. The val. of n in $\log(H_3BO_3 + n \log[\text{erythritan}]) + K = -2p_H$ is 1·3, which agrees, contrary to Böeseken, with the val. for fructose. F. R. G.

Determination of reaction velocity and velocity constants of bimolecular reactions. A. LOTTERI

(Annali Chim. Appl., 1937, **27**, 439—444).—A theoretical derivation of the abs. val. of the velocity coeff. of a bimol. reaction, and the reaction velocity equation, expressing the yield as a function of time, is given. L. A. O'N.

Extrapolation to zero decomposition. D. N. ANDREEVSKI (J. Phys. Chem. Russ., 1937, **9**, 64—70).—A theoretical discussion of the method of identifying the primary products of a decomp. reaction by extrapolation to the beginning of the process. E. R.

Chemical reactions as an intramolecular diffusion phenomenon. II. J. A. CHRISTIANSEN (Z. physikal. Chem., 1937, **B**, **37**, 374—386; cf. A., 1936, 1072).—From an equation for the "internal activity" of an atom in a mol. the equation $k = [D/4\pi\sqrt{(ab)}]e^{-l^2/4(a+b)}$ has been deduced for the velocity coeff. of a reaction. Here a, b, and l can be determined from the potential curve, $a \propto$ the temp. (K.), T, and b may be some other function of T. The linear relation between frequency index and activation no. (cf. *ibid.*, 1204) may be explained by the present theory if it is assumed that the particle displaced in the reaction has an electric moment and that near the potential max. the field is so weak that the mean moment of the particle is given by Debye's equation. R. C.

Effect of temperature on flame speed, and temperature gradient at flame front. H. SACHSSE (Z. physikal. Chem., 1937, **180**, 305—313).—By measuring the height of the inner cone of a Bunsen flame the relation between the flame speed, v, in mixtures of O_2 with CH_4, C_2H_6, and C_3H_8 and the O_2 content and the temp., θ, at which the gas mixture is preheated has been studied. With rising θ, v increases only slowly, the rise being due solely to the approach of θ to the inflammation temp., θ_1. The rate of the combustion reaction has no appreciable effect on v or on the temp. gradient at the flame front. Owing to the induction period preceding ignition, the observed θ_1 is the lower the more time is allowed for inflammation to occur. R. C.

Thermal decomposition of dimethyl sulphite. R. C. WOOD and H. A. TAYLOR (J. Physical Chem., 1937, **41**, 1091—1099).—Decomp. data over the range 360—390°/10—250 mm. indicate that the mechanism involves free radicals producing CH_4, CO, SO_2, H_2, and Me_2SO_2. No Me_2O could be detected. The activation energy of Me_2SO_3 is 55,000 g.-cal. It is suggested that Prinz (A., 1884, 1255) worked with $EtSO_2{\cdot}OEt$, not $(EtO)_2SO$. F. R. G.

Kinetics and mechanism of decomposition of hydrocarbons. V. Thermal decomposition of dodecane, ββδ-trimethylpentane, and βε-dimethylhexane. A. I. DINTZES and C. I. KLABINA. **VI. Kinetics of decomposition of ethane at reduced pressures.** A. I. DINTZES, A. KVIATKOVSKI, A. D. STEPUCHOVITSCH, and A. V. FROST (J. Gen. Chem. Russ., 1937, **7**, 1507—1514, 1754—1761).—V. The composition of the reaction products obtained by pyrolysis (500—570°) of βε-dimethylhexane and ββδ-trimethylpentane is in good agreement with that expected on the basis of Rice's theory (A., 1931, 819), whilst in the case of n-$C_{12}H_{26}$ more C_2H_4 and less CH_4 are produced than would follow from this theory.

VI. The rate of decomp. of C_2H_6 at 600° is inversely $\propto$ pressure, at 1—60 mm. The velocity of decomp. falls progressively, probably owing to attainment of equilibrium conditions at >60 mm., and at <60 mm. owing to the inhibitive action of some unidentified reaction product. Addition of $CH_2{:}CHMe$, but not of C_2H_4 or n-C_4H_8, retards decomp. of C_2H_6 at $\gtrsim$60 mm. and 612°. R. T.

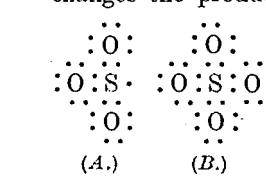
Mechanism of polymerisation reactions. H. MASH (Naturwiss., 1937, **25**, 753—757).—A review.

Kinetics of polymerisation.—See A., II, 3.

Decomposition of hypochlorites. III. Kinetics of decomposition of aqueous hypochlorites in presence of ammonia. A. P. ZAKOSCHTSCHIKOV, R. G. NESHELSKAJA, and N. A. PICHUNOVA (J. Appl. Chem. Russ., 1937, **10**, 1380—1402).—The rate of decomp. of NaOCl in presence of aq. NH_3 is at a max. with 1 mol. of NH_3 per 2 mols. of NaOCl. The reaction is represented as $NH_4Cl + NaOCl \rightarrow NH_2Cl + NaCl + H_2O$; $NH_2Cl + NaOCl \rightarrow NHCl_2 + NaOH$; the alkalinity of the solution may thus rise during the process of activated bleaching. The temp. coeff. of the process is 1·93, as compared with 2·5 in absence of NH_3; the velocity of reaction rises with increasing p_H, to a greater extent in conc. than in dil. solutions of NaOCl. R. T.

Oxidation of aqueous sulphite solutions. III. Mechanisms of sulphite oxidation. P. BAUMGARTEN and H. ERBE (Ber., 1937, **70**, [*B*], 2235—2264; cf. A., 1936, 434).—The oxidation of aq. sulphite has been studied in the presence of substances capable of yielding stable compounds with the unstable intermediates. In addition to Cu^{II} salts (*loc. cit.*), KSO_4, HSO_5, H_2O_2, and the electric current have been used for oxidation and C_5H_5N, $CO(NH_2)_2$, dioxan, and glycine as indicators; NH_3, H_3BO_3, alkali fluoride, and excess of sulphite are useful if used at high concn. All the indicators have pronouncedly co-ordinative, unsaturated character; saturated compounds (SO_4'', PO_4''', CO_3'') are ineffective. Three types of sulphite oxidation are distinguished. Cu^{II} salts and HSO_5 give characteristically 1-pyridiniumsulphonic acid (I) in addition to SO_4'' and S_2O_6''; $2Cu^{\cdot\cdot} + C_5H_5N + SO_3'' \rightarrow 2Cu^{\cdot} + C_5H_5N^{+}{\cdot}SO_2{\cdot}O^-$ and $SO_2(O{\cdot}OH)O' + C_5H_5N + SO_3'' \rightarrow C_5H_5N^{+}{\cdot}SO_2{\cdot}O^- + SO_4'' + OH'$. Anodic oxidation and KSO_4 do not afford (I) but the yield of dithionate ($2SO_3'' - 2e \rightarrow S_2O_6''$ and $S_2O_8'' + 2SO_3'' \rightarrow S_2O_6'' + 2SO_4''$) is $\gg$ in the absence of C_5H_5N under similar conditions. In addition SO_4'' is produced. Only with KSO_4 are 2- and 3-pyridylpyridinium salts (II) produced. These are produced incomparably more rapidly than from C_5H_5N and KSO_4 alone so that their production is intimately related to sulphite oxidation. With H_2O_2, even in presence of C_5H_5N, SO_4'' is almost exclusively produced, the formation of (I) and (II) not being detectable. The presence of C_5H_5N causes no increase of S_2O_6''. If oxidation is effected in presence of another indicator, anodic oxidation is accompanied by formation of a greatly increased amount of S_4O_6''.

In presence of NH_3 anodic oxidation, HSO_4', or KSO_4', but not Cu^{II} salts, cause production of $NH_2{\cdot}SO_3H$; except in the case of anodic oxidation the yield of S_2O_6'' does not exceed that observed in H_2O. Oxidation in alkaline solution of approx. const. [OH'] is a change of the second order but the determinations do not permit conclusions with regard to definite intermediate reactions. In explanation of the changes the production of monothionic ions (*A*) and



(*A*.) (*B*.)

*iso*monothionic ions (*B*) is assumed. The evidence of discharge of SO_3 at S or O is regarded as dependent on the oxidising agent, *B* being intermediate when (I) is produced in presence of C_5H_5N whereas *A* is prominent wherever S_2O_6'' is the characteristic product. The probable reaction is $C_5H_5N + A \rightarrow C_5H_5N - A \rightarrow (+A)\ S_2O_6'' + C_5H_5N$. Analogous additive intermediates are assumed with $CO(NH_2)_2$, dioxan, glycine, H_3BO_3, F', and SO_3''. The failure of coordinatively unsaturated H_2O to give an enhanced yield of S_2O_6'' is attributed to the presence of a mobile proton which renders isomerisation possible, so that contact with *A* causes removal of the superfluous charge with production of H_2SO_4 thus: $H_2O + A \rightarrow H_2O - A \rightarrow (+A)\ H_2SO_4 + SO_3''$. The action of NH_3 is similar to that of H_2O for the same cause: $NH_3 + A \rightarrow NH_3 - A \rightarrow (+A)\ NH_2{\cdot}SO_3H + SO_3''$. The production of $NH_2{\cdot}SO_3H$ by the anodic oxidation of SO_3'' solutions containing NH_3 is not accompanied by diminution of the S_2O_6'' yield and is conditioned by the peculiar conditions of the experiment such as the located discharge of *A* at the surface of the electrode. The production of (II) is explained: $S_2O_8'' + SO_3'' \rightarrow SO_4'' + A + B$ and $2B + 2C_5H_5N + A \rightarrow HSO_4' + [C_5H_5N{\cdot}C_5H_4N] + SO_4'' + SO_3''$, and as concurrence reaction, $B + SO_3'' \rightarrow SO_4'' + A$. In alkaline solution SO_4'' can be used in the discharge of OH' which can then react: $OH + SO_3'' \rightarrow OH' + A$. Oxidation by H_2O_2 leading rapidly to the almost exclusive formation of SO_4'' is unaffected by the presence of C_5H_5N or similar indicators and can therefore take place only to a completely subordinate extent through intermediates of the type described above. The main process is in all probability an immediate transference of O from H_2O_2 to SO_3'', thus: $H_2O_2 + SO_3'' \rightarrow SO_4'' + H_2O$. H. W.

Steric factor in reactions in solution. W. BRENSCHEDE (Z. physikal. Chem., 1937, **180**, 403—404; cf. A., 1937, I, 522).—Polemical against Hückel (*ibid.*, 86, 622). J. W. S.

Kinetics of addition of HOCl to double linkings. IV. HOCl and Δ^{β}-butene-$\alpha\delta$-diol. E. A. SCHILOV and N. P. KANJAEV (J. Phys. Chem. Russ., 1937, **9**, 123—131).—The addition of HOCl to Δ^{β}-butene-$\alpha\delta$-diol in aq. solution at 0° is a second-order reaction in respect to HOCl. It is catalysed by HCl. In presence of alkali the reaction $\propto$ [HOCl][OCl$^-$]. E. R.

Oxidation velocities of alkenes with peracetic acid. J. BÖESEKEN and J. STUURMAN (Rec. trav. chim., 1937, **56**, 1034—1038).—The rates of reaction of several alkenes and cyclenes with AcO_2H in AcOH solution have been measured at different temp. The vals. of *E* and *B* in the Arrhenius equation $\log k = -(E/2303RT) + B$ have been calc. The reaction coeff. increases considerably as H on the unsaturated C atoms is replaced by alkyl groups; this is ascribed to the fall in the *E* vals. In the cyclic compounds the *B* vals. also fall. E. S. H.

Effect of polar groups on esterification velocities of substituted benzoic acids. R. J. HARTMAN and A. M. BORDERS (J. Amer. Chem. Soc., 1937, **59**, 2107—2112).—The velocity of reaction of several substituted benzoic acids with MeOH in presence of H$^{\cdot}$ has been determined. The effect of substituent polar groups is to increase the velocity by displacement of electrons towards the CO_2 group. The vals. of $\log k$ for the esterification agree with those predicted by Hammett's equation (A., 1937, I, 142). The non-exponential factor of the Arrhenius equation as well as the activation energy increases on passing from the rapidly to the slowly esterified acids. E. S. H.

Kinetics of the production of anthraquinone compounds from benzoylbenzoic acid derivatives. —See A., 1937, II, 507.

Stepwise mechanism of the hydrolysis of dissolved polyoxymethylene dimethyl ethers.—See A., II, 4.

Absorption of carbon dioxide. D. H. KILLEFFER (Ind. Eng. Chem., 1937, **29**, 1293).—The rate of absorption of CO_2 by aq. Na_2CO_3 is greatly accelerated by the presence of small amounts of CH_2O, MeOH, EtOH, Pr$^{\beta}$OH, soap, PhOH, Na lactate, Na alkyl sulphates, and $N(C_2H_4{\cdot}OH)_3$. It is inferred that the usual slowness of absorption is due to surface tension rather than to viscosity effects. J. W. S.

Kinetics of luminescence of white phosphorus. K. JABŁCZYŃSKI and H. JABŁCZYŃSKA-JĘDRZEJEWSKA (Rocz. Chem., 1937, **17**, 431—435).—The velocity coeff. of extinction of the luminescence of white P is $k = (\log Q_0/Q)/t$ where Q_0 and Q are respectively the intensity of luminescence initially and at time *t*. The effect is due to formation of a protective oxide film on the P surface. R. T.

Velocity of dissolution of lead in acids. I. G. TEDESCHI (Atti R. Accad. Lincei, 1937, [vi], **25**, 641—647).—Spongy Pb dissolves in 2—8N-H_2SO_4 with a velocity $\propto [H_2SO_4]^2$. The temp. coeff. of the reaction is 1·85. O. J. W.

Influence of transitional states on the rate of formation of cobalt spinel from the solid oxides. J. A. HEDVALL and L. LEFFLER (Z. anorg. Chem., 1937, **234**, 235—238).—The increased reactivity of solids during the transition between two cryst. forms is exemplified by the reaction $CoO + Al_2O_3 = CoO,Al_2O_3$. With Al_2O_3 which has been dried at 800° there are sudden increases in reaction rate at about 900° and 1000° corresponding with the formation of the γ- and α-Al_2O_3 lattices, respectively. If, however, the Al_2O_3 has been ignited at 1100° these effects are not found. If Co_3O_4 is used instead of CoO the reaction rate is greater owing to the formation of "nascent" CoO, and particularly when the oxides are heated in N_2 instead of O_2. F. J. G.

Influence of magnetic transformations on the speed of formation of ferrites. H. FORESTIER and R. LILLE (Compt. rend., 1937, **205**, 848—850).—Mixtures of Fe_2O_3 and various co-pptd. oxides were heated for 0·5 hr. at 400—850°, and the variation in magnetisation was studied at room temp. The curves of magnetisation against temp. show a max. at 675°, indicating an increase in the speed of formation of ferrites in the neighbourhood of the Curie point of Fe_2O_3. Further max. appear: Fe_2O_3,NiO 590°, Fe_2O_3,BaO 460°, Fe_2O_3,PbO 465°, Fe_2O_3,CuO 460°, and Fe_2O_3,SrO 480°. R. S. B.

Combustion of detonation of solid explosives.—See B., 1937, 1411.

Deuterium in catalytic and photochemical researches. H. S. TAYLOR (J. Chim. phys., 1937, **34**, 529—535).—A summary of published work, with particular reference to the reactions of D_2 with hydrocarbons. E. S. H.

Reduction of peroxysulphate by manganous ion and by hydrazine with silver ion as catalyst. A. O. DEKKER, H. A. LÉVY, and D. M. YOST (J. Amer. Chem. Soc., 1937, **59**, 2129—2131).—The reactions are: (1) $S_2O_8'' + Mn^{••} + 2H_2O = 2SO_4'' + MnO_2 + 4H^•$, (2) $2S_2O_8'' + N_2H_5^• = 4SO_4'' + N_2 + 5H^•$. The rate $\propto [S_2O_8'']$ and $[Ag^•]$ and is independent of $[Mn^{••}]$ or $[N_2H_5^•]$. The sp. reaction rates for $Mn^{••}$ and $N_2H_5^•$ differ but little. The mechanism suggested involves the oxidation of $Ag^•$ to $Ag^{•••}$ by means of S_2O_8'', followed by rapid reaction between $Mn^{••}$ or $N_2H_5^•$ and $Ag^{•••}$, forming $Ag^•$. The effect of the ionic strength on the rate of each reaction is in qual. agreement with predictions from Brönsted's theory. E. S. H.

Oxidation of phenols by ozone in aqueous solution and in sulphuric acid solutions of various concentrations, in presence of manganese sulphate. L. I. KASCHTANOV and O. N. OLESCHTSCHUK (J. Gen. Chem. Russ., 1937, **7**, 1413—1416).—The oxidation of PhOH by O_3 in H_2O is not a chain reaction. The velocity of oxidation $\propto [H_2SO_4]$ of the solution. The reaction is catalysed by $MnSO_4$. R. T.

Catalytic action of copper oxide in the combustion of hydrogen. G. TEDESCHI (Gazzetta, 1937, **67**, 609—611).—A reply to a criticism by van Cleave and Rideal (A., 1937, I, 315). O. J. W.

Stability of solutions of tervalent niobium in sulphuric acid. S. J. KIEHL, R. L. FOX, and H. B. HARDT (J. Amer. Chem. Soc., 1937, **59**, 2395—2399).—The extent of the reaction $Nb^{III} + 2H^• \rightleftharpoons Nb^V + H_2$ has been determined by measuring $[Nb^{III}]$ at different time intervals; the catalytic influence of Pt-black has been determined by measuring the increase of pressure at const. vol. Unidentified blue crystals were observed in conc. solutions of $[Nb^{III}]$ in 3M- and 6M-H_2SO_4. Red crystals appearing during the reduction of 6—9M-H_2SO_4 saturated with Nb_2O_5 and $KHSO_4$ are tentatively assigned the empirical formulæ $4K_2O,2Nb_2O_3,Nb_2O_5,12H_2SO_4,12H_2O$ and $4K_2O,2Nb_2O_3,Nb_2O_5,13H_2SO_4,16H_2O$. E. S. H.

Action of hydrogen fluoride on vanadium–barium catalysts for oxidation of sulphur dioxide.—See B., 1937, 1335.

Preparation of oxide catalysts by deposition of aërosols. II. Intermediate compounds in the catalytic oxidation of carbon monoxide on ferric oxide. K. IVANOV and N. KOBOSEV (J. Phys. Chem. Russ., 1937, **9**, 1—17).—The reaction $2CO + O_2 = 2CO_2$ is of zero order on a Fe_2O_3 aërosol at 400°, and of the first order at 500—550°. It is of the first order on ordinary Fe_2O_3 powders at all temp. The activation energy is the same in both cases (8·15 kg.-cal.). Strong sorption of CO (up to 1·3 mols. per mol. of Fe_2O_3) occurs during the reaction. The activation energy of sorption is 4·45 kg.-cal. on the Fe_2O_3 powder and 2·04 kg.-cal. on the aërosol. Results can be explained by the assumption of the existence of intermediate compounds $(Fe_xO_y)(CO)_z$, with $x : y > 2 : 3$. E. R.

Catalytic dehydration of ethyl alcohol by alumina. II. W. A. ALEXANDER, W. R. HORN, and L. A. MUNRO (Canad. J. Res., 1937, **15**, B, 438—446; cf. A., 1935, 1210).—At 450° 100% of C_2H_4 is produced and is not affected by the H_2O content of the Al_2O_3, but at 318° the max. of 25% C_2H_4 corresponds with an optimum H_2O content of 1%, whilst the optimum H_2O content (5%) for formation of Et_2O is independent of temp. The effect of ageing the catalyst also exhibits a max. F. R. G.

Autoxidation of monolayers. I. Mechanism of autoxidation of maleic anhydride–β-elæostearin. G. GEE and E. K. RIDEAL. **II. Catalysts and inhibitors.** G. GEE (J. Chem. Physics, 1937, **5**, 794—801, 801—807).—I. Monolayers of maleic anhydride–β-elæostearin (I) on 0·01N-H_2SO_4 or -HCl spontaneously undergo a series of reactions identifiable with the normal process of drying of an oil, autoxidation being followed by polymerisation of the oxidation product (A., 1935, 1080; 1936, 434). The autoxidation of the double linking remote from the glyceride residue is now considered and the effects of pressure and temp. over a wide range of p_H are investigated. It is shown that the substrate is involved in the oxidation and that p_H has a profound effect. The effective oxidising agent is thus shown to contain no element except O or H and a free radical mechanism involving HO_2 and O_2' is postulated. The kinetics of the proposed mechanism are given and abs. vals. of such consts. as can be determined are consistent with the physical picture of the process.

II. The rate of oxidation of (I) is accelerated by the addition of $CoSO_4$ and increases progressively as the [Co] increases. With other metals more complicated results are obtained. Addition of pro- and anti-oxygens to the substrate gave complex results; the behaviour of quinol has been studied in detail. The catalytic effect depends on the p_H of the substrate. Results are discussed in the light of the free radical mechanism postulated above and a semi-quant. treatment, which accounts satisfactorily for the principal features of the results, has been developed. W. R. A.

Negative catalysts in the hydrogenation of fatty oils.—See B., 1937, 1366.

Catalytic hydrogenation of oils.—See B., 1937, 1297.

Dominant processes in electrolytic separation of hydrogen on active palladium and platinum electrodes. L. KANDLER, C. A. KNORR, and C. SCHWITZER (Z. physikal. Chem., 1937, **180**, 281—304).—Partly an amplification of a previous paper (A., 1936, 1343). If the electrode is sufficiently active, the rate of the electrode process as a whole is, even in strongly alkaline solution, determined by the rate of diffusion of mol. H_2. It has been deduced theoretically and confirmed experimentally that the electrode potential is given by $E = -0{\cdot}029 \log [(AF + I)/AF]$, where I is the c.d. and AF the amount of H_2 diffusing to the electrode per sec. The electrode is probably able to remove protons, not only from $H_3O^{\cdot}$ ions, but also from H_2O, an analogous process possibly constituting the mechanism of the passage of current through dielectric liquids. R. C.

Platinum electrode as catalyst for the activation of hydrogen. II. M. CALVIN and H. E. DYAS (Trans. Faraday Soc., 1937, **33**, 1492—1495).—Further experiments confirming conclusions previously published (A., 1936, 1212) are described. F. L. U.

Anodic formation of chlorine dioxide in the electrolysis of perchloric acid. G. GRUBE and K. H. MAYER (Z. Elektrochem., 1937, **43**, 859—863).—When conc. solutions of $HClO_4$ are electrolysed at high c.d. more O_2 is liberated at the anode than corresponds with $2ClO_4' + H_2O = 2HClO_4 + 0{\cdot}5O_2 + 2\ominus$. ClO_2 and $HClO_3$ are also formed at the anode. The phenomena agree quantitatively with the view that a part of the discharged ClO_4' ion breaks up into ClO_2 and O_2, whilst a part of the ClO_2 is then oxidised electrolytically to $HClO_3$. F. J. G.

Discharge of alkali metals during electrolysis of carnallite.—See B., 1937, 1358.

Silver oxide positive of the alkaline accumulator.—See B., 1937, 1362.

Electrodeposition of copper on aluminium after preliminary chemical oxidation.—See B., 1937, 1359.

Formation of complexes in some salt melts. G. WIRTHS (Z. Elektrochem., 1937, **34**, 486—491).—Electrolysis of fused $PbCl_2$ (alone and mixed with KCl) containing Th-*B* in a divided cell with a capillary between the two compartments and determinations of the radioactivity of the contents of the two compartments after several hr. indicated that no complex $PbCl_4''$ or $PbCl_3'$ anions are formed in pure $PbCl_2$ but that such occur in KCl–$PbCl_2$ mixtures to an extent which is the greater the higher is the % of KCl in the mixture. The cathode yield of Cd when the metal is electrolysed under a bath of molten $CdCl_2$ saturated with Cd is always >100% calc. on $Cd^{\cdot\cdot}$; the existence of Cd_2Cl_2 in the metal is, therefore, inferred. A. R. P.

Behaviour of lead in nickel-plating baths.—See B., 1937, 1358.

Electrolyses with alternating current and tin electrodes in alkaline medium. E. VALLESI (Annali Chim. Appl., 1937, **27**, 157—164).—The electrolysis of 0·2—4·0N-NaOH solutions with a.c. (50 cycles per sec.) and Sn electrodes has been studied. At room temp. and with concns. > N a black deposit of Sn is formed on the electrodes, no H_2 is evolved, and Sn is dissolved as stannate. At higher temp. and with concns. < N the Sn deposit is non-adherent and is dissolved as stannite with evolution of H_2. O. J. W.

Electrodeposition of tin.—See B., 1937, 1358.

Action of a dark electric discharge on a mixture of nitric oxide and hydrogen. Production of ammonia. C. ZENGHÉLIS and K. EVANGÉLIDIS (Praktika, 1935, **10**, 208—212; Chem. Zentr., 1936, i, 3789; cf. A., 1935, 176).—Formation of NH_3 was a max. (65 vol. %) at low pressures, high c.d., and in the range 14—153°. N_2H_4 and NH_2OH were not detected. The NH_3 yield is lowered by a large excess of H_2. H. J. E.

Photochemical reactions. G. K. ROLLEFSON (Z. physikal. Chem., 1937, **B**, **37**, 472—473).—A reply to criticisms (A., 1936, 1228; 1937, I, 91) of mechanisms suggested by the author for the formation of $COCl_2$ and the bromination of C_2H_2. R. C.

Photochemical studies. XXV. Direct photochemical decomposition of nitrous oxide. W. A. NOYES, jun. (J. Chem. Physics, 1937, **5**, 807—812).—The no. of mols. of gas uncondensed by liquid air, produced from N_2O per quantum adsorbed in the presence and absence of Hg vapour, indicates partial primary decomp. into N_2 and O, but formation of NO and N cannot be definitely excluded. The mechanism involves the subsequent reactions $O + N_2O = 2NO$ and $O + O = O_2$. Weakness of the absorption suggests possible formation of N_2 and O in their normal electronic states. W. R. A.

Topography of the latent photographic image. A. KEMPF (Z. wiss. Phot., 1937, **36**, 235—250).—The distribution of the latent image in the interior of a AgBr grain was investigated for a specially prepared large- and uniform-grained emulsion. The surface of the grains (size and no. measured at each stage under the microscope) was treated alternately with a solvent for Ag [0·1N-$(NH_4)_2S_2O_8$] to remove the latent image in the surface exposed, and with a AgBr solvent (1% $Na_2S_2O_3$ + 1% KBr, + 5 c.c. of 10% NaOH per 100 c.c. of the solution of the first two) to remove a suitably thick layer from the grain. The latent image in the surface layer at each stage was determined by development and measurement of the density of blackening, and also by determination of Ag; these methods all led to closely similar results. The original exposure of the emulsion was made with visible light (40-watt lamp) and also by *X*-rays. Results show that the rate of fall in concn. of the latent image from the outside to the interior of the AgBr grain is slow, although it is greater near the surface than further in the interior; the rate of fall is considerably less in the case of the *X*-ray image. With physical development, whereby Ag nuclei remaining after each stage of AgBr dissolution will be developed, thus leaving the same amount of developable centres, a stepped curve is to be expected, and is obtained, in

place of the smooth curve. It is noted that the latent *X*-ray image is much more resistant to Ag solvent than the ordinary-light image. It is thus proved that the latent image is distributed throughout the grain; such fall as occurs in the interior is attributed to a real reduction in nucleus formation. Light absorption cannot occur in the case of *X*-rays. With ordinary light, absorption may also contribute to the decreasing concn. Ordinary development reduces only the exterior layer of the grains. J. L.

Effect of concentration on the production of the latent photographic image by hydrogen peroxide. M. W. JONES and J. M. BLAIR (J. Chem. Physics, 1937, **5**, 835—836).—Examination of data obtained concerning the latent image produced by various concns. of H_2O_2 suggests that initially there is a net reaction of second order and indicates an optimum concn. for production of max. density. W. R. A.

Mass and distribution of photolytic silver in silver bromide-gelatin emulsions of different grain size. III. Mass and distribution of photolytic silver in films without nitrite. W. MEIDINGER (Physikal. Z., 1937, **38**, 905—919; cf. B., 1937, 151; A., 1937, I, 626).—The amount of photolytic Ag formed by a given amount of radiation depends on grain size, being for the larger-grained > for the smaller-grained emulsions. The max. quantities of Ag deposited at const. intensity of radiation are smaller for small-grained emulsions. The amount of Ag formed is for damp films > for dry ones, and there is a variation in the amount of Ag deposited with temp. of film during exposure. The addition of an acceptor for the Br eliminated increases the photo-efficiency 60 times. The effect depends on the concn. of the acceptor, which also decides the effectiveness of the acceptor in reducing solarisation. The photolytic Ag may be divided into inner and surface Ag. The amount of surface Ag increases linearly with exposure, whilst the curve of inner Ag reaches a limit. There is no connexion between the mass of photolytic Ag and solarisation. A. J. M.

Photochemical transformations of methane, ethane, propane, and *n*-butane. III. W. KEMULA and A. DYDUSZYŃSKI (Rocz. Chem., 1937, **17**, 423—430).—The effect of ultra-violet illumination of the gaseous hydrocarbons is as follows: $CH_4 \rightarrow CH_2^{\cdot} + H_2$; $2CH_2^{\cdot} \rightarrow C_2H_4 \rightarrow$ polymerides; $C_nH_{2n+2} \rightarrow C_nH_{2n} + H_2$; $C_nH_{2n} \rightarrow$ polymerides. R. T.

Photochemical oxidation of trichloroethylene to dichloroacetyl chloride sensitised by chlorine. K. L. MÜLLER and H. J. SCHUMACHER (Z. physikal. Chem., 1937, **B**, **37**, 365—373; cf. A., 1937, I, 370).—In light of λ 436 mμ. a yield of $CHCl_2{\cdot}COCl$ > 95% results: $C_2HCl_3 + 0{\cdot}5O_2 = CHCl_2{\cdot}COCl$. The rate ∝ the intensity of absorbed light, is independent of $[C_2HCl_3]$ and $[O_2]$, and has the temp. coeff. ~1·12. At 95° the quantum yield is ~40. The formation of a peroxide, $C_2HCl_4O_2$, is probably an essential step in the chain mechanism. A side reaction is $C_2HCl_3 + 1{\cdot}5O_2 = CO_2 + HCl + COCl_2$. R. C.

Photochemical decomposition of aliphatic alcohols in aqueous solution. L. FARKAS and Y. HIRSHBERG (J. Amer. Chem. Soc., 1937, **59**, 2450—2453).—Under the action of light from a Hg arc, aq. MeOH, EtOH, and $Pr^{\alpha}OH$ decompose yielding H_2 and the corresponding aldehyde; the aldehyde is partly decomposed in a subsequent photochemical reaction. The quantum yield for the decomp. of EtOH is 0·8. $Pr^{\beta}OH$ yields H_2 and $COMe_2$, which is further decomposed in a subsequent reaction. E. S. H.

Photolysis of aliphatic aldehydes. V. Acraldehyde. F. E. BLACET, G. H. FIELDING, and J. G. ROOF (J. Amer. Chem. Soc., 1937, **59**, 2375—2379; cf. A., 1936, 437).—A correlation between photochemical polymerisation and the absorption spectrum has been found. Between λ 3660 and 3130 (sharp-banded absorption) the quantum yield Φ_P is <0·5; at λ 3020 (very diffuse absorption) $\Phi_P = 1{\cdot}0$; at λ 2804 (border between banded and continuous absorption) $\Phi_P = 10$; at λ 2654 and 2537 (continuous region) $\Phi_P = 19$. The large quantum yields are explained by a mechanism involving free radicals. An induction period in polymerisation has been observed. E. S. H.

Photochemical decomposition of aliphatic aldehydes in aqueous solutions. Y. HIRSHBERG and L. FARKAS (J. Amer. Chem. Soc., 1937, **59**, 2453—2457).—The decomp. of aq. CH_2O (I), MeCHO (II), acetaldol (III), crotonaldehyde (IV), and EtCHO (V) under the influence of light from the Hg arc has been investigated. (III) is formed from MeCHO according to $2MeCHO = OH{\cdot}CHMe{\cdot}CH_2{\cdot}CHO$, and it is suggested that the formation of an aldehyde mol. with free valencies is the photochemical primary process. The quantum yield (no. of aldehyde mols. disappearing per absorbed quantum) is 0·5 for (I), 2·5 for (II), ≪1 for (IV), and 1·8 for (V). E. S. H.

Photo-oxidation of acetone vapour. P. FUGASSI (J. Amer. Chem. Soc., 1937, **59**, 2092—2093).—The quantum yield of the photo-oxidation of $COMe_2$ vapour at 25° using λ 3130 A. is 0·24. Assuming that 1 mol. of O_2 reacts with 1 mol. of $COMe_2$, the quantum yield for the oxidation of $COMe_2$ = that for its decomp. A similar oxidation reaction of $COMe_2$ occurs in the electrical discharge. E. S. H.

Free radicals in solution. D. H. HEY and W. A. WATERS (Nature, 1937, **140**, 934—935).—The close similarity between the properties of free alkyl radicals produced photoehemically in solution (A., 1937, I, 471) and those of the free aryl radicals formed by the decomp. of diazo-hydroxides etc. (A., 1937, II, 97) is discussed. L. S. T.

Photosynthesis of carbohydrates *in vitro*. E. C. C. BALY (Nature, 1937, **140**, 930).—Carbohydrates are photosynthesised when a surface of NiO coated with an adsorbed layer of hydrated CO_2 is irradiated with white light. The two successive photochemical reactions are: $4NiO,CO_2,H_2O + h\nu_1 = 2Ni_2O_3,CHOH$ and $2Ni_2O_3,CHOH + h\nu_2 = 2Ni_2O_3 + CHOH$, where $h\nu_1$ is a quantum of blue light (λ = 4000 A.) and $h\nu_2$ one of red light (λ = 6400 A.), and CHOH is a mol. of activated formaldehyde which polymerises on the surface to a carbohydrate. These processes are followed by the dark

reaction $2Ni_2O_3 = 4NiO + O_2$. The first product of photosynthesis is a complex carbohydrate which is unstable and polymerises or condenses to a more complex carbohydrate. This is stable in solution, and is not hydrolysed by acid or by diastase. It appears to be the hitherto unknown parent of a starch. The essential for success is a surface of a true cryst. lattice of NiO, and all failures to achieve photosynthesis have been due to the dispersion of the Ni compound by alkali. L. S. T.

Becquerel effect and photochemical reactivity of coloured organic molecules. (MLLE.) C. STORA (J. Chim. phys., 1937, **34**, 536—597; cf. A., 1935, 429, 586, 682).—A general review and discussion. The effect is caused by the photochemical reaction between the photo-sensitive substance and the surrounding medium. In the case of oxidised mols. in equilibrium with their reduction products the effect depends on the lability of the oxidation–reduction equilibrium. The mechanism is discussed. E. S. H.

Effect of the simultaneous action of radiations of different frequencies on the bromination of cinnamic acid and stilbene. J. C. GHOSH, S. K. BHATTACHARYYA, and M. L. N. MURTHI (J. Indian Chem. Soc., 1937, **14**, 452—462).—The velocities of reaction in CCl_4 have been determined iodometrically at 31° under the simultaneous influence of two radiations of different λ selected from 546, 436, and 406 mμ. The combined effect of two radiations is always < the sum of the two individual effects, and the velocity coeff. for monochromatic radiation $\propto$ the square root of the intensity of the absorbed radiation. E. S. H.

Long life of excited organic molecules, exemplified by the rubrene oxidation. H. GAFFRON (Z. physikal. Chem., 1937, **B**, **37**, 437—461).—Data supporting the theory of the oxidation previously advanced (A., 1933, 1214) are recorded. In the photo-oxidation of rubrene (I) in C_6H_6 solution the quantum yield, γ, rises rapidly with concn., c, to a limit of 1. The effect of the O_2 pressure, p, on γ is negligible when c is large and considerable when c is small. γ is not affected by the intensity or λ of the absorbed radiation. Contrary to Koblitz and Schumacher's findings (A., 1937, I, 255) γ for high c does not converge continuously to zero as p falls, but when the O_2 is used up γ abruptly falls from a large val. to zero. The high val. of γ for small p can be explained only by supposing that there is in addition to the ordinary short-lived active form of (I) an activated form which is comparatively long-lived, and during its life every collision leads to reaction. Evidence of the presence of two active forms of (I) is also afforded by the observation that if c is large and a foreign colouring matter is present as sensitiser, γ is independent of p, whereas if c is small and a considerable amount of a foreign acceptor is present γ falls with p. In dil. solution (I) transports O. R. C.

Oxidation of rubrene in light. H. J. SCHUMACHER (Z. physikal. Chem., 1937, **B**, **37**, 462—467).—Comments on Gaffron's paper (cf. preceding abstract). R. C.

Differential aëration as a factor in the localisation of corrosion.—See B., 1937, 1355.

Corrosion of metals.—See B., 1937, 1355.

Rôle of diffusion in the oxidation of copper and iron. L. CZERSKI (Rocz. Chem., 1937, **17**, 436—443).—Oxidation of Cu in air at 950° consists initially of the processes $Cu \rightarrow Cu_2O \rightarrow CuO$; the surface layer of CuO is relatively impermeable to O_2, so that dissociation of CuO to Cu_2O and O or O_2 takes place. At the same time Cu diffuses outwards from the metal surface to the oxide layer, and undergoes oxidation at the boundary of the CuO layer; this process is responsible for the oxidation of the bulk of the metal. Analogous results are found for Fe. R. T.

Displacement of gold from chloride solutions by hydrogen at high pressures. V. G. TRONEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 317—320).—H_2 at 1 atm. reduces $HAuCl_4$ (0·02N) to Au^I at first, and a ppt. of Au appears only after an induction period of about 1 hr. In presence of an excess of NaCl this is increased to several hr. Complete pptn. of the Au is not possible. At 100 atm. without stirring Au is pptd. very slowly, but the rate of reaction increases rapidly with increasing speed of stirring, whilst at a given speed of stirring the rate of reaction increases with increasing pressure. Excess of HCl causes a decrease in the rate of reaction. With rising temp. the rate of reaction increases only slightly from 18° to 50°, but much rapidly from 50° to 75°. F. J. G.

Chemical and electrochemical factors in the attack of acids on metals. Acid corrosion of magnesium and aluminium. A. QUARTAROLI and O. BELFIORI (Gazzetta, 1937, **67**, 565—573; cf. A., 1937, I, 250).—The action of aq. solutions of acids on Mg and on Al is compared. With Mg the metal is attacked mainly by H_2O and by mols. of undissociated acid, whereas with Al the action is mainly due to $H^{\cdot}$. The action on pure Al of N-HCl containing small amounts of H_2O_2 is ascribed to the formation of a spongy, loosely adherent oxide film, which disturbs the polarised Al surface and allows it to be attacked by $H^{\cdot}$. O. J. W.

Crystallisation of calcium fluoride from the fused state. E. V. ZECHNOVITZER (J. Phys. Chem. Russ., 1937, **9**, 88—99).—CaF_2 was fused in ZrO_2 crucibles. The largest single crystals obtained were <5 mm. No transparent agglomerations could be obtained by re-melting. One of the main causes of failure was the decomp. of CaF_2 with the formation of >3% of CaO. E. R.

Action of bromine on mercuric oxide. M. LEMARCHANDS and P. PIERRON (Bull. Soc. chim., 1937, [v], **4**, 1773—1783).—The first product is *HgOBr*$_2$, which decomposes to form HgBr and either $Hg(BrO_3)_2$ or $Hg(BrO)_2$ according to the conditions. E. S. H.

Action of mercury on solutions of potassium chromate and dichromate. R. PARIS (Bull. Soc. chim., 1937, [v], **4**, 1803—1811).—Hg remains almost unchanged in aq. $K_2C_2O_4$, but the reaction $2K_2CrO_4 + 6Hg + 5H_2O = 3Hg_2O + 2Cr(OH)_3 +$

4KOH occurs slowly. Hg slowly transforms neutral aq. $K_2Cr_2O_7$ into K_2CrO_4 and $H_2Cr_2O_7$; in presence of HCl, $Cr^{\cdots}$ is formed quantitatively, whilst with H_2SO_4 or HNO_3 Hg_2CrO_4 is formed; in presence of AcOH slow but quant. reduction to $Cr^{\cdots}$ occurs. E. S. H.

Mercury infection of aluminium. A. Quartaroli and O. Belfiori (Gazzetta, 1937, **67**, 557—565). The action of N-HCl and of N-HNO_3 on Al, with and without previous deposition of traces of Hg on the Al, has been studied. The results are used to obtain information regarding the state of the Al_2O_3 film on the Al surface. A freshly formed film completely covers the Al surface and renders it passive towards HCl even after treatment with a dil. $HgCl_2$ solution. An ordinary Al surface, which is covered with a more or less aged film, when treated with dil. $HgCl_2$ solution, is rapidly attacked by N-HCl. O. J. W.

Structure, energy content, and other properties of active substances. XXII. Size of the primary particles, secondary structure, and energy content of various active γ-aluminium oxides. R. Fricke, F. Niermann, and C. Feichtner (Ber., 1937, **70**, [*B*], 2318—2330).—Differences in the energy content amounting to nearly 4 kg.-cal. per g.-mol. of Al_2O_3 are observed between the various active conditions of γ-Al_2O_3 obtained by heating at 500—800° $Al(OH)_3$ pptd. from hot solution (very finely-divided böhmite). It is shown röntgenographically that these differences are not due to differences in the lattice consts. or to lattice distortions. The primary particles of all specimens are very small and diminish as the energy content increases. The phenomena resemble closely those observed with γ-Fe_2O_3. The relationship is linear between energy content and primary particle size (or extent of mol.-surface calc. on the assumption of cubical particles). Primary particle size therefore here determines the energy content. The slope of the graph indicates a total surface energy of 560 ergs per sq. cm. for γ-Al_2O_3; this no. is a lower limit. Investigation of the preps. by Hahn's emanation method using radiothorium gives for the initial hydroxide a max. emanatory power ($EmV = 58\%$); the emanatory power of the oxides produced therefrom diminishes as the temp. is raised and the duration of heating is prolonged. The "surfaces" reckoned from the EmV vals. are somewhat < those calc. from the size of the primary particles and have no clear relationship to the energy content of the specimens. The results obtained explain the great suitability of γ-Al_2O_3 as catalyst and catalyst carrier. It is remarkable that after comparatively drastic ignition (6 hr. at 800°) the primary particles are still very small (40 A.) and the EmV very considerable (33%). This prep. is considered to have an energy content about 5·5 kg.-cal. per mol. > that of the form poorest in energy. The hygroscopicity of γ-Al_2O_3 is also explained; this persists after ignition at 1000° and disappears when γ-Al_2O_3 passes into α-Al_2O_3 above 1100°. H. W.

Corrosion probability [for aluminium].—See B., 1937, 1357.

Preparation of aluminium silicofluoride. V. Schtscherbakova (J. Appl. Chem. Russ., 1937, **10**, 1403—1404).—$Al_2(SiF_6)_3$ is prepared from $Al(OH)_3$, HF–H_2SiF_6, and SiO_2 gel. R. T.

Compounds of gallium. II. P. Neogi and S. K. Nandi (J. Indian Chem. Soc., 1937, **14**, 492—494; cf. A., 1936, 1217).—$GaPO_4,3H_2O$ has been obtained by (*a*) dissolution of $Ga(OH)_3$ in H_3PO_4 or (*b*) interaction of aq. $Ga(NO_3)_3$ and Na_2HPO_4; $Ga(ClO_3)_3,H_2O$ by double decomp. of aq. $Ga_2(SO_4)_3$ and $Ba(ClO_3)_2$; $Ga(IO_3)_3,2H_2O$ by adding HIO_3 to a solution of Ga in HNO_3; $Ga(IO_3)_3,Ga_2O_3,3H_2O$ by mixing aq. $NaIO_3$ and $Ga(NO_3)_3$. Ga bromate is unstable; it has been prepared in solution, but not isolated. E. S. H.

Thallium sulphides, selenides, and tellurides. I. Thallium selenides. A. Baroni (Atti R. Accad. Lincei, 1937, [vi], **25**, 621—625).—The f.p. curve and *X*-ray examination of the system Tl–Se show that only the compounds Tl_2Se_3 and Tl_2Se exist. O. J. W.

Chemical investigations of silicates. VI. Behaviour of enstatite, $MgSiO_3$, towards melting chlorides of bivalent metals. E. Thilo (Ber., 1937, **70**, [*B*], 2267—2272).—Exchange occurs when enstatite (I) is heated in N_2 in absence of O_2 with the molten chloride of the requisite bivalent metal, the sequence of decreasing readiness being $Co^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Fe^{\cdot\cdot}$, and $Ni^{\cdot\cdot}$. No reaction occurs with $ZnCl_2$ or $CdCl_2$. The Debye diagrams of the products are identical with that of (I). In general reaction occurs less readily with (I) than with the metasilicate derived from talc. If O_2 is present, orthosilicates sol. in HCl are produced. H. W.

Affinity. LXXV. Sulphides of titanium. W. Biltz and P. Ehrlich [with K. Meisel] (Z. anorg. Chem., 1937, **234**, 97—116).—The system Ti–S has been investigated röntgenographically and (in part) tensimetrically. In addition to the known mono-, sesqui-, and di-sulphides a *trisulphide* and one or more *subsulphides* exist. TiS_3 is prepared by heating Ti or a lower sulphide with S and removing excess in vac. It resembles graphite and has d^{20} 3·22, heat of formation 4 kg.-cal. per g.-mol. It is sol. in hot H_2SO_4 whilst hot HNO_3 yields TiO_2. TiS_2 and Ti_2S_3 are the upper limits of homogeneous ranges which extend down to $TiS_{1\cdot7}$ and $TiS_{1\cdot1}$, respectively. At high temp. the range of solid solutions extends from TiS_2 to $TiS_{1\cdot48}$. Preps. having the ratio $S:Ti < 1 > 0{\cdot}25$ do not show the lines of TiS or of Ti; they differ from TiS in being readily attacked by HCl, yielding H_2S, and at approx. 1000° they give sublimates consisting of violet and silvery-white crystals. In TiS_3, TiS_2, Ti_2S_3, TiS, and "$TiS_{0\cdot5}$" the at. vols. of S are 11, 12, 11, 9, and 6, respectively. F. J. G.

Preparation and properties of the higher oxides of lead. G. L. Clark, N. C. Schieltz, and T. T. Quirke (J. Amer. Chem. Soc., 1937, **59**, 2305—2308).—The products of heating PbO_2, NaOH, and H_2O in a pressure bomb under different conditions have been identified by *X*-ray analysis as Pb_2O_3 and Pb_5O_8. Large single crystals may be obtained. At higher temp. Pb_3O_4 is produced. A Pb–Na–O compound of undetermined composition is reported. E. S. H.

Efficiency at 90° of phosphorus pentoxide as a desiccant. D. A. LACOSS and A. W. C. MENZIES (J. Amer. Chem. Soc., 1937, **59**, 2471—2472).—The efficiency at 90° = that at room temp. E. S. H.

Metaphosphoric acid derived from Graham's salt. (MME.) R. SALIH (Bull. Soc. chim., 1937, [v], **4**, 1724—1726).—The complexity of Na metaphosphates varies with the method of prep. When Graham's salt is pptd. by $Pb^{\cdot\cdot}$ it undergoes a modification of structure, yielding a product which is identical with that obtained from $Na_6(PO_3)_6,10H_2O$. E. S. H.

Individuality of phosphorus nitrides P_3N_5, P_4N_6, $(PN)_n$, and their modes of hydrolysis. I. General. II. Experimental. H. MOUREU and G. WETROFF (Bull. Soc. chim., 1937, [v], **4**, 1839—1850, 1850—1857).—I. Published work is reviewed. The possibility of the existence of $PN(OH)_2$ is discussed.

II. The products of hydrolysis by H_2O in sealed tubes have been identified by chemical and *X*-ray analysis. P_3N_5 yields $(NH_4)_2HPO_4$ and $NH_4H_2PO_4$; $(PN)_n$ gives initially $NH_4H_2PO_3$, which is subsequently converted into $NH_4H_2PO_4$ and H_2; P_2N_6 yields $(NH_4)_2HPO_4$, $NH_4H_2PO_4$, $NH_4H_2PO_3$, and H_2. E. S. H.

Combined action of heat and hydrogen on alkaline-earth arsenates. H. GUÉRIN (Bull. Soc. chim., 1937, [v], **4**, 1885—1895; cf. A., 1937, I, 92).—Reduction of arsenate to arsenite occurs at 350° for Ca, 400° for Sr, and 450° for Ba; decomp. of arsenite to oxide occurs at 350° for Ca, 600° for Sr, 700° for Ba; arsenide is formed only with Ba. E. S. H.

Pharmaceutically important arsenic compounds. II.—See A., 1937, II, 491.

Exchange reactions with radio-sulphur. H. H. VOGE and W. F. LIBBY (J. Amer. Chem. Soc., 1937, **59**, 2474).—Exchange of S and radio-S occurs between S'' and S_2O_3'', but not between S'' and SO_4'' or SO_3'' and SO_4''. E. S. H.

Oxidation of aqueous sulphide solutions by hypochlorites. A. R. CHOPPIN and L. C. FAULKENBERRY (J. Amer. Chem. Soc., 1937, **59**, 2203—2207).—The end-products of the reaction are S and SO_4'', which are formed in quantities depending on the concns. of the reagents, the temp., and p_H. High [NaOCl] and rising temp. increase the proportion of SO_4''. A min. in the production of SO_4'' occurs at p_H 10. E. S. H.

Behaviour of thiosulphate and the formation of higher polythionic acids in fuming hydrochloric acid. J. JANICKIS (Z. anorg. Chem., 1937, **234**, 193—223).—The nature of the clear solution which is obtained when aq. $Na_2S_2O_3$ is dropped into fuming HCl (A., 1924, ii, 104) has been investigated. The views of Bassett and Durrant (A., 1927, 843) as to the nature of the substance present in acidified thiosulphate solutions which reduces methylene-blue are criticised, and it is suggested that this substance is $H_2S_2O_3$. A method for quant. analysis of the solution has been worked out, and the results indicate that it contains $H_2S_2O_3$, SO_2, higher polythionic acids, and a little H_2S. At 0° it deposits no S for some 8 hr., and during this time its composition changes continuously, $[H_2S_2O_3]$ decreasing and $[SO_2]$ increasing, while the no. of mols. of polythionic acids passes through a min. and their average S content through a max. corresponding approx. with $H_2S_{14}O_6$. Even after 24 hr., when quite turbid, the solution still contains $H_2S_2O_3$. The results are interpreted as follows: at the moment of prep. $H_2S_5O_6$ is formed according to $H_2S_2O_3 + H_2O \rightleftharpoons 2H_2SO_2$ and $H_2SO_2 + 2HS_2O_3' \rightarrow S_5O_6'' + 2H_2O$, whilst the formation of H_2S is due to $3H_2SO_2 \rightleftharpoons H_2S_2O_2 + SO_2 + 2H_2O$ and $H_2S_2O_2 \rightarrow SO_2 + H_2S$. Subsequently the following reactions occur: $S_nO_6'' + H_2S_2O_3 \rightarrow S_{n+1}O_6'' + SO_2 + H_2O$; $2S_nO_6'' + 4H^{\cdot} \rightarrow (2n-5)S + 5SO_2 + 2H_2O$; $S_nO_6'' + S \rightarrow S_{n+1}O_6''$; $5H_2S_2O_3 \rightarrow 2H_2S_5O_6 + 3H_2O$; $S_5O_6'' + S_nO_6'' \rightarrow S_{5+a}O_6'' + S_{n-a}O_6''$. The stability of the solution is due to the fact that the direct decomp. to $S + SO_2$ is a property not of undissociated $H_2S_2O_3$ but of the ion HS_2O_3'. F. J. G.

Sulphur selenium protochloride. Refractive index and surface tension of mixtures of sulphur with selenium protochloride, Se_2Cl_2. A. BARONI (Atti R. Accad. Lincei, 1937, [vi], **25**, 719—723; cf. A., 1933, 241).—By the fractional distillation of mixtures of S and Se_2Cl_2, previously heated for 6 hr. in a sealed tube at 200°, an orange *liquid*, $SSeCl_2$, b.p. 68°/20 mm., has been isolated. Evidence for the existence of this compound has also been obtained from measurements of n and γ for S–Se_2Cl_2 mixtures at various temp. $SSeCl_2$ has n_D^{20} 1·7234, d_4^{20} 2·1502; it is more stable than $SeSCl_2$ and probably has the structure $S{:}Se{:}Cl_2$. O. J. W.

Preparation of chromium fluoride. V. SCHTSCHERBAKOVA (J. Appl. Chem. Russ., 1937, **10**, 1405—1406).—CrO_3 is dissolved in a 10% excess of HF, a 20% excess of C is added, and the mixture is heated at 80°, when the reaction $2CrO_3 + 6HF + 3C \rightarrow 2CrF_3 + 3CO_2$ takes place. R. T.

Preparation of 12-molybdophosphoric acid. S. L. MALOWAN (Z. anal. Chem., 1937, **111**, 7—10).—$(NH_4)_3PO_4,12MoO_3$ is heated to incipient redness, forming a blue-black *substance* of the apparent composition $8MoO_2,16MoO_3,P_2O_5$. This is dissolved in 3% aq. H_2O_2, acidified with HNO_3, and evaporated, giving pure, alkali-free molybdophosphoric acid. J. S. A.

Resistance of metals to hydrofluosilicic acid.—See B., 1937, 1356.

Affinity. LXXVI. Tensimetric analysis of the higher phosphides of manganese. W. BILTZ and F. WIECHMANN [with K. MEISEL] (Z. anorg. Chem., 1937, **234**, 117—129).—The highest compound is a *triphosphide*, MnP_3, d 4·26. MnP_3 takes up excess of P into solid solution, but MnP_3 and MnP form an almost ideal two-phase system. There are no indications of the existence of MnP_2 (A., 1914, ii, 273). F. J. G.

Pentaiodorhenic acid. W. BILTZ [with F. W. WRIGGE, E. PRANGE, and G. LANGE] (Z. anorg. Chem., 1937, **234**, 142—149).—When K_2ReI_6 in 20% H_2SO_4 is shaken with Et_2O all of the Re and 5/6 of the I, but none of the K, pass into the

upper layer. In this ethereal solution the Re is quadrivalent, so that the equation is $K_2ReI_6 + H_2SO_4 = (K_2SO_4 + HI)$ aq. $+ HRe^{IV}I_5$ (in Et_2O). The reaction is sp. for K_2ReI_6; with the Cl and Br compounds little or no Re is absorbed by Et_2O. A definite solid compound of Re and I could not be isolated. F. J. G.

Physico-chemical nature of oxides of nickel. D. P. BOGATZKI (J. Gen. Chem. Russ., 1937, **7**, 1397—1402).—The composition of oxides of Ni prepared by heating $Ni(NO_3)_2$ varies according to the temp., from NiO at >1100° through a series of solid solutions to NiO_2 at 500°. The *X*-ray diagrams of the oxides Ni_3O_4 and Ni_2O_3 differ from that of NiO only in their larger space lattice const., suggesting that these are solid solutions of NiO in NiO_2. R. T.

Compounds of platinum with unsaturated hydrocarbons of the ethylene series. A. D. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 351—354; cf. A., 1937, II, 54).—Replacing Cl by Br, or C_2H_4 by propylene, *iso*butylene, or styrene, prep. and properties are given for further members of the complex type: $[C_2H_4\ X\ PtCl_2]$ where $X = NH_3$ or C_5H_5N. As with the chlorides, *trans*-forms are obtained from Zeise type salts, *cis*- from Coss type. $[C_2H_4\ X\ PtCl_2]$ with KBr yield the *bromides*. The olefines are inter-replaceable, showing residual affinities in the order $C_3H_8 > C_2H_4 > C_3H_6$ or C_4H_8 (cf. A., 1936, 1098). $[C_2H_4\ NH_3\ PtCl_2]$ when boiled with HCl yields Coss' salt, showing elimination of C_2H_4 to be the primary reaction. The results confirm the *trans*-influence in the inner shell of the unsaturated mols. I. McA.

Designation of capabilities of quantitative methods of determination. A. SCHLEICHER (Z. anal. Chem., 1937, **111**, 3—7; cf. Reichel, A., 1937, I, 528).—An alternative method of expressing the precision and applicability of analytical methods is discussed. J. S. A.

Technique of spectral analysis. W. GERLACH and W. ROLLWAGEN (Metallwirts., 1937, **16**, 1083—1094).—Recent progress in qual. and quant. spectral analysis is reviewed. C. E. H.

Direct photo-electric determination of elements in the flame. J. HEYES (Angew. Chem., 1937, **50**, 871—874).—The flame spectra of the elements to be determined are excited under standardised conditions, using a Lundegårdh atomiser. Suitable lines are isolated by means of a monochromator, and their intensity is measured directly with a photo-electric cell. At low concens., the photo-electric current directly ∝ the concn. of the element concerned. J. S. A.

Comparative p_H measurements with the hydrogen and glass electrodes. K. SCHWABE [with W. GRAUPNER] (Z. Elektrochem., 1937, **43**, 874—879).—Comparisons of the glass electrode (SiO_2 72, CaO 6, Na_2O 22%) with the H_2 electrode in solutions of a no. of partly neutralised acids over the p_H range 1 to 10 show that they agree within the experimental error except in the case of $CCl_3{\cdot}CO_2H$, where large divergences, which may be attributed to catalytic hydrogenation, are found. F. J. G.

p_H measurements with the glass electrode. G. HAUGAARD (J. Soc. Leather Trades Chem., 1937, **21**, 582—586).—The glass electrode and a sensitive, low-capacity potentiometer are very trustworthy and accurate to approx. 0·02 p_H. A suitable modified vac.-tube potentiometer is described (cf. A., 1937, I, 567). D. W.

Two new colour indicators from β-naphthylamine.—See A., 1937, II, 494.

Use of naphthol compounds as fluorescent indicators. M. DÉRIBÉRÉ (Ann. Chim. Analyt., 1937, [iii], **19**, 262—263).—The fluorescent properties of numerous naphthols, naphtholsulphonic acids, and their derivatives are recorded and the compounds proposed for use as indicators. J. S. A.

Acridine-orange and brilliant-diazole-yellow as fluorescent indicators. M. DÉRIBÉRÉ (Ann. Chim. Analyt., 1937, [iii], **19**, 290—291; cf. A., 1933, 1132).—Commercial samples of acridine-orange exhibit a brick-red and the pure material a yellow-green fluorescence at p_H 8—10·5. The fluorescence of diazole-yellow changes from green to yellow-green with increase in concn. There is no fluorescence below p_H 7·5, or in the presence of oxidising agents. J. L. D.

Modified distillation method for [the determination of] moisture. H. N. CALDERWOOD and R. J. PIECHOWSKI (Ind. Eng. Chem. [Anal.], 1937, **9**, 520).—In the Dean–Stark method (B., 1920, 438) with xylene as the immiscible liquid, the introduction of a few drops of EtOH removes H_2O adhering to the inner wall of the condenser tube, and thus increases the accuracy of the method. The EtOH should be added only after dehydration of the sample is complete and should not be used as an indicator to show when this is the case. Rates and periods of boiling are specified. L. S. T.

Microchemical detection of halogen. F. HALLA and F. RITTER (Mikrochim. Acta, 1937, **1**, 365).—One drop of the test solution is heated with 2—4 drops of fuming HNO_3 in the usual form of apparatus, and the liberated halogen, halogen acid, or NOCl absorbed by a drop of acid $AgNO_3$ solution. The limiting sensitivity is $<10^{-6}$ g. L. S. T.

Determination of chlorides and bromides. L. A. REBER and W. M. MCNABB (Ind. Eng. Chem. [Anal.], 1937, **9**, 529).—0·1N-$AgNO_3$ is added to the Cl′ or Br′ solution in presence of dil. HNO_3, the coagulated halide is filtered off, and the combined filtrate and washings are titrated with 0·1N-KI using starch and Ce^{IV} NH_4 sulphate solution as indicator. The results agree with those obtained by the Volhard and gravimetric methods. I′ can be similarly determined, filtration of the pptd. AgI being unnecessary. When the iodide is titrated with $AgNO_3$ the end-point appears too soon, probably owing to adsorption of I′ by the AgI. L. S. T.

Determination of bromates in chlorates by Junck's method. I, II. F. TARADOIRE (Bull. Soc. chim., 1937, [v], **4**, 1759—1771, 1771—1773).—I. The applicability of Junck's method has been investigated, with special reference to the action of

atm. O_2 and light, the presence of Cu and Fe, and the influence of the nature and amount of acid used.

II. Results of analysis are reported. E. S. H.

Determination of micro-quantities of iodine. J. F. REITH and C. P. VAN DIJK (Biochem. J., 1937, **31**, 2128—2135).—New methods have been tested. A rapid and trustworthy method based on extraction of I′ from salt mixtures by EtOH (cf. Hamilton, A., 1936, 1351) is described. The reduction of IO_3' in alkaline solution by N_2H_4 also gave good results. No detectable IO_3' is formed on heating a mixture of I′, NO_3', and CO_3''. Small amounts of org. material (*e.g.*, 50 mg.) can be destroyed with practically no loss of I′ by heating with $NaNO_3$. J. N. A.

Dioxan as a reagent for detection and determination of small amounts of iodide. Application to the detection of iodide in iodised salt. A. SAIFER and J. HUGHES (J. Biol. Chem., 1937, **121**, 801—802; cf. A., 1937, I, 260).—A correction. J. W. S.

Determination of iodine in organic medicaments.—See B., 1937, 1406.

Stability of potassium iodate volumetric solutions. S. M. BERMAN (J. Assoc. Off. Agric. Chem., 1937, **20**, 590—592).—Solutions prepared as suggested (*ibid.*, 57) and standardised by As_2O_3 show no appreciable loss of stability in 20 months, and the method is therefore suggested as a tentative standard. J. G.

Determination of fluorine. J. J. T. GRAHAM (J. Assoc. Off. Agric. Chem., 1937, **20**, 392—394).—The Willard–Winter method (A.O.A.C. Methods of Analysis, 1935, **19**(b), 46) gives low results in presence of large amounts of Al and SiO_3''. In such cases the PbFCl method is applied. E. C. S.

Determination of fluorine by peroxidised titanium method. D. DAHLE (J. Assoc. Off. Agric. Chem., 1937, **20**, 505—516).—Use is made of the inhibitory action of Al salts on the bleaching by F of peroxidised Ti to eliminate errors due to variation in p_H or to adventitious colours, aq. $Al(NO_3)_3$ being added to an aliquot part of the solution of F which is to be analysed. The colours developed are determined by the use of a neutral wedge photometer (cf. Clifford and Wichmann, A., 1936, 443) and compared with those developed in standard solutions of F. The interference by other ions when this procedure is used is negligible unless present in amounts $\gg$ those tolerated in any other method of determination of F. E. C. S.

Volumetric micro-determination of 0·01N-sulphate solutions with sodium rhodizonate as indicator. E. ABRAHAMCZIK and F. BLÜMEL (Mikrochim. Acta, 1937, **1**, 354—364).—The red colour of Ba rhodizonate (I) is discharged in acid solution owing to decomp. of the liberated rhodizonic acid, and although (I) is stable in neutral solution the colour change from red to yellow in the titration of an aq. Ba salt with aq. SO_4'' and Na rhodizonate as indicator is not sharp. When buffered to p_H 3 by citrate and HCl and diluted with 3 vols. of MeOH, 0·01N-$BaCl_2$ can be satisfactorily titrated with 0·01N-$(NH_4)_2SO_4$, but not the SO_4'' with the Ba solution. The method has been applied to the determination of S in org. elementary analysis, and to the titration of HSO_4' and free H_2SO_4 solutions. Interfering cations are removed from SO_4'' solutions by adsorption with zeolite. L. S. T.

Determination of total reducible sulphur in caustic soda.—See B., 1937, 1333.

Rapid determination of sulphide sulphur.—See B., 1937, 1335.

Microchemical detection of selenium. F. FEIGL and V. DEMANT (Mikrochim. Acta, 1937, **1**, 322—325).—SeO_3'' in 2N-HCl gives first a red and then a reddish-violet colour with 1% $NPh_2{\cdot}NH_2$ in glacial AcOH; limiting sensitivity $0{\cdot}05 \times 10^{-6}$ g. SeO_2. Se, selenides, and SeO_4'' are first converted into SeO_3''. IO_3', ClO_3', MnO_4', etc. and peroxides must be destroyed by warming with HCl, whilst Fe''', Cu'', tungstates, and molybdates are converted into complex oxalates by boiling with HCl + $H_2C_2O_4$. TeO_3'' and TeO_4'' give no reaction, and 0·001% Se can be detected in 20 mg. of S or Te. Sulphides and Se minerals are attacked by heating with conc. HCl and perhydrol. L. S. T.

Determination of selenium. Z. SHIBATA (Sci. Rep. Tôhoku, 1937, [i], **26**, 248—252).—The determination of Se by pptn. with SO_2, and iodometric titration after addition of KI, is described. F. J. L.

Determination of phosphoric acid in superphosphate and phosphorite meal.—See B., 1937, 1334.

Semi-micro-methods for the rapid colorimetric determination of arsenic. F. GAUDY and M. P. ANTOLA (Anal. Asoc. Quím. Argentina, 1937, **25**, 76—80).—Material containing 0·1—1 mg. of As is evaporated with HNO_3 and H_2SO_4 to a colourless residue, and then reduced with N_2H_4,H_2SO_4, the product being treated with HCl, 1% gelatin, and finally a saturated solution of H_2S. As is determined by colorimetric comparison with standard solutions. Bi, Sn, Cu, and Fe must be removed before the final pptn. The effect of varying the amount of gelatin is recorded. The method is suitable for rapid commercial analyses. F. R. G.

Volumetric determination of arsenic, antimony, and bismuth with potassium iodide. L. FAUCHON and L. VIGNOLI (J. Pharm. Chim., 1937, [viii], **26**, 337—341; cf. A., 1937, I, 478).—The vol. of a standard solution of a Bi salt in HNO_3 or 10% H_2SO_4 required to produce a yellow colour with KI is compared with that of the unknown, the Bi content of which is calc. Sb and As can be determined similarly in 25% and 40% H_2SO_4, respectively. J. L. D.

Determination of silicic acid in substances soluble in acids. W. VAN TONGEREN (Chem. Weekblad, 1937, **34**, 774—777).—A comparative examination of the HCl, HNO_3, $HClO_4$, NH_4Cl–HCl, and NH_4NO_3–HNO_3 methods for separating SiO_2 from sol. silicates shows that the last gives the most trustworthy results and the smallest degree of contamination of the SiO_2, which is due in this case

almost entirely to TiO_2. In the preferred method 1 g. of finely powdered sample is intimately mixed with 1 g. of NH_4NO_3 in a small Jena glass beaker covered with a watch-glass. 5 c.c. of HNO_3 (*d* 1·4) are added, and the mixture is warmed on the water-bath for 0·5 hr. with stirring. The SiO_2 is then collected in a folded paper containing a small wad of macerated paper in the bottom of the cone, washed with 100—125 c.c. of hot 5% HNO_3 containing a few drops of H_2O_2, ignited in Pt, and weighed. The residue is treated with HF and SiO_2 determined by difference. S. C.

Determination of silicon in steels.—See B., 1937, 1351.

Rapid determination of inert gas content of nitrogen.—See B., 1937, 1335.

Micro-reaction for lithium. I. M. Korenman and M. M. Fursina (J. Appl. Chem. Russ., 1937, **10**, 1494—1495).—A drop each of solution, of 15% $(CH_2)_6N_4$, and of 15% $K_3Fe(CN)_6$ are mixed; characteristic octahedra form in presence of $<6 \times 10^{-8}$ g. Li. Mg, Na, Rb, and Cs do not interfere. R. T.

Micro-reactions for cæsium and rubidium. I. M. Korenman and G. J. Jagniatinskaja (J. Appl. Chem. Russ., 1937, **10**, 1496—1499).—A drop of solution is evaporated to dryness on a slide, and a drop each of saturated aq. $K_3Fe(CN)_6$ and $Pb(OAc)_2$ are placed on the residue; characteristic micro-crystals of $Cs_3Fe(CN)_6,Pb(OAc)_2$ are formed (6×10^{-7} g. Cs). Cs (6×10^{-8} g.) or Rb (3×10^{-6} g.) is detected microscopically by placing a granule of $KBiI_4$ in a drop of solution, when hexagonal crystals form within 15 min.; a similar, more sensitive reaction is obtained by substituting Sb for Bi in the reagent. Alternatively, Cs (3×10^{-8} g.) or Rb ($1·5 \times 10^{-7}$ g.) is detected as characteristic crystals of $Cs_2AuPdCl_7$ or $Rb_2AuPdCl_7$. K, Na, Li, and Mg do not interfere with the above reactions, except in very great excess. R. T.

Determination of lime in cement etc.—See B., 1937, 1343.

Investigation of several metals with a single reagent. M. Soares (Rev. Chim. pura appl., 1937, [iii], **12**, 1—11).—A review of the use of $SH{\cdot}CH_2{\cdot}CO_2H$ in the detection and determination of heavy metals. F. R. G.

Quantitative mineralogical *X*-ray analysis. T. N. Agafonova (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 367—369).—Relative intensity ratio $I_A(hkl)/I_B(mno)$–% composition curves determined by photometry of suitable pairs of lines in *X*-ray powder photographs of binary A–B mixtures, are applied to determine the % of component A in a mixture, by adding a known % of a standard B (Fe, Al, NaCl) and recording I_A/I_B for the same line-pairs. Curves are given for the binary mixtures apatite–Al; MnO_2–Mn_2O_3. Without special precautions, some components are claimed to be determinable to <1%. I. McA.

Determination of lead in presence of other metals. C. Mahr and H. Ohle (Z. anorg. Chem., 1937, **234**, 224—228).—Pb can be separated from other metals by pptn. from HNO_3 solution with $CS(NH_2)_2$ at 0° as $2Pb(NO_3)_2,11CS(NH_2)_2$. The ppt. can be dissolved in hot H_2O and Pb determined by the usual methods. F. J. G.

Determination of lead in motor fuel.—See B., 1937, 1298.

Application of mercurimetry to the determination of thallium. J. Tetílek (Z. anal. Chem., 1937, **111**, 10—14).—Tl is pptd. by adding a measured excess of KI. TlI is filtered off, and the excess of KI is titrated back with standard $Hg(NO_3)_2$, using diphenylcarbazone as indicator. J. S. A.

Use of micro-analytical methods in rock analysis. F. Hecht (Z. anal. Chem., 1937, **110**, 385—401).—The micro-analytical determination of elements present in traces (0·01—0·02%) in rocks is reviewed. Cu may be determined colorimetrically with $NEt_2{\cdot}CS_2Na$, or gravimetrically by pptn. with 5 : 7-dibromo-8-hydroxyquinoline (I). The SiO_2 is removed from the rock by fuming with HF + H_2SO_4. The residue is dissolved in H_2O and Cu is pptd. with H_2S at room temp. The ppt. is dissolved in HCl + HNO_3, and Cu pptd. with (I). Mn, Zn, Ni, and Co are pptd. with H_2S from the ammoniacal solution after removing Fe, Al, etc. as basic acetates. Mn and Zn are separated by Hillebrand's method, and Zn is pptd. with 8-hydroxyquinoline in presence of much NH_4OAc. Org. compounds in the filtrate are destroyed by treatment with HCl + HNO_3, and then with H_2O_2 + HNO_3. Mn is pptd. by treatment with Br–H_2O + NH_3, and the ppt. is ignited to Mn_3O_4 at 1000°. The sulphides are dissolved in HCl + HNO_3 and evaporated down with HCl. Pt and Cu are pptd. in HCl solution with H_2S. Ni in a portion of the filtrate is pptd. with dimethylglyoxime; Co is pptd. with 1 : 2-$NO{\cdot}C_{10}H_6{\cdot}OH$ and ignited to Co_3O_4. Ca co-pptd. with Mg is determined by dissolving the $Mg_2P_2O_7$ in dil. H_2SO_4, and adding 9—10 parts of EtOH. The $CaSO_4$ is collected, dissolved in HCl, and pptd. with $H_2C_2O_4$. The CaC_2O_4 is ignited at 1000°, and reconverted into $CaSO_4$. Sr is determined after extracting the nitrates with EtOH + Et_2O, by fuming down with H_2SO_4, and collecting $SrSO_4$ formed. Ba is determined in a separate sample which is fused with Na_2CO_3 + $NaNO_3$. The melt is extracted with H_2O, and the insol. portion is treated with H_2SO_4. The residue is treated with HF + H_2SO_4, leaving Ba and Sr (+Ca) as sulphates. These are brought into HCl solution by fusion with Na_2CO_3, and Ba is pptd. as $BaSO_4$. Rare earths are pptd. with Fe and Ti by means of KOH, from the sample used for determining Ba, and are obtained as insol. fluorides on evaporating with HF. The rare earths are finally converted into the oxalates, by double pptn., and are ignited to the oxides. Total S is determined in the H_2O extract from the Na_2CO_3–$NaNO_3$ fusion, and is pptd. as $BaSO_4$. Cl is determined in the H_2O extract after fusion with Cl-free Na_2CO_3. J. S. A.

Electrolytic analysis of white and yellow metal alloys.—See B., 1937, 1353.

Determination of mercurous chloride and total mercury in mercury ores.—See B., 1937, 1354.

Colour reactions of rare-earth elements with alkaloids and polyhydric phenols. IV. Colour

reactions of cerium, lanthanum, thorium, thallium, and elements of the third analytical group with morphine salts. F. M. SCHEMJAKIN and V. A. VOLKOVA (J. Gen. Chem. Russ., 1937, **7**, 1553—1556).—Ce^{IV} in aq. NH_3 gives a brown ppt. with morphine hydrochloride (I) ($< 10^{-5}$ g. Ce per ml.); pptn. proceeds periodically, giving well-defined Liesegang rings. Th, La, and group III cations do not interfere. Tl^{III} gives a yellow ppt. with (I), but not with brucine. R. T.

Quantitative spectroscopic determination of neodymium and praseodymium in minerals. S. A. BOROVIK and T. A. BUROVA (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 311—312).—The rare earths and Th, after separation of other metals, are made up to a 1% solution and Pr and Nd determined by adjusting the thickness of a layer of a standard solution to equal brightness of the lines 5270—5207 A. for Nd and 4879 A. for Pr. F. J. G.

Purity tests in assaying by means of spot tests.—See B., 1937, 1355.

Precipitation of basic gallium sulphate by means of carbamide. II. Separation and determination of gallium. H. H. WILLARD and H. C. FOGG (J. Amer. Chem. Soc., 1937, **59**, 2422—2424; cf. A., 1937, I, 473).—Ga is pptd. quantitatively as basic sulphate when aq. $Ga_2(SO_4)_3$ containing $CO(NH_2)_2$ is heated until p_H 4—5·5 is reached. Ga can be separated from Zn and Mn, and within certain limits from Ca, by this process. Al, Cr, and Fe interfere. E. S. H.

Determination of manganese in silicate rocks. O. HACKL (Z. anal. Chem., 1937, **110**, 401—406; cf. A., 1936, 813).—Previously published specifications are supplemented. J. S. A.

Determination of manganese in sea-water. V. KRASNOVA (J. Gen. Chem. Russ., 1937, **7**, 1417—1418).—Minor modifications of Schmidt's method (B., 1928, 110) are suggested. R. T.

Spectrographic determinations on cast iron.—See B., 1937, 1348.

Gravimetric determination of chromic acid as lead chromate. D. TSCHAVDAROV and N. TSCHAVDAROVA (Z. anal. Chem., 1937, **110**, 348—354).—CrO_4'' may be pptd. as $PbCrO_4$ from solutions approx. 0·1—0·2N in HNO_3; the ppt. is dried at 160—180°. High results may be obtained in the presence of HCl; most cations do not interfere. J. S. A.

Preservation of ammonium molybdate reagent. S. SAITÔ (Sci. Rep. Tôhoku, 1937, [i], **26**, 253—260).—The usual solution of NH_4 molybdate (75 g. per l. of 3N-HNO_3) is highly supersaturated with respect to $MoO_3,2H_2O$, which separates as a yellow ppt. on keeping the reagent. The rate of crystal growth is small and the solution can often be preserved for some time, but the most stable solution contains 25 g. per l. in 5N-HNO_3. The effect of heat and light on the formation of the ppt. is small. F. J. L.

Determination of tungstates. E. CARRIÈRE and R. BERKEM (Bull. Soc. chim., 1937, [v], **4**, 1907—1912).—Existing procedures have been critically examined. Minor modifications are suggested. E. S. H.

Determination of uranium, thorium, and lead in thucholite. O. B. MUENCH (J. Amer. Chem. Soc., 1937, **59**, 2269—2270).—The Pb–U ratio is 0·038, whence it is estimated that the approx. age of the mineral is 278×10^6 years. E. S. H.

Iodometric determination of tin. M. HEGEDÜS (Z. anal. Chem., 1937, **110**, 338—348).—The Sn, in HCl solution, is reduced completely to Sn'' by addition of Zn + a little Cd, air being first displaced by CO_2. When the Zn and Cd have dissolved, a HCl solution containing a weighed excess of $KBrO_3$ + 10 parts of KI is added, and the excess of I is titrated back with $Na_2S_2O_3$. In presence of Pb, the original solution is first treated with an excess of Na_2SO_4; 10 parts of Pb do not interfere with the determination of Sn. J. S. A.

Reduction of iron with metallic tin. R. RINNE (Z. anal. Chem., 1937, **111**, 1—3).—Fe''' in HCl solution may be reduced to Fe'' by heating with Sn. The solution is decanted from undissolved metal, $HgCl_2$ is added, and Fe is titrated as usual. The method has advantages over the use of the Zn reductor. J. S. A.

Drop reaction for titanium. M. V. GAPTSCHENKO and O. G. SCHEINTZIS (J. Gen. Chem. Russ., 1937, **7**, 1427—1428).—A drop of solution is placed on filter-paper saturated with tannin, followed by a drop of 20% antipyrin; a red spot forms in presence of $< 2 \times 10^{-7}$ g. Ti. The colorations given by Fe, U, or V, but not by Ti or Mo, are discharged by 20% H_2SO_4. Cr, Al, Co, Ni, Mn, Zn, Hg, Pb, Cu, Cd, Bi, and Zr do not interfere. R. T.

Fractional reaction for zirconium and the precipitation of amorphous precipitates. N. A. TANANAEV (J. Appl. Chem. Russ., 1937, **10**, 1514—1520).—Polemical, in reply to Alimarin (A., 1936, 1354; 1937, 1, 259). R. T.

Organic reagents capable of application to mineral analysis. 2 : 3 : 7-Trihydroxy-9-methyl-6-fluorone, special reagent for antimony cations. P. WENGER, R. DUCKERT, and C. P. BLANCPAIN (Helv. Chim. Acta, 1937, **20**, 1427—1445; cf. A., 1937, I, 330).—Among the elements of group VIII the ions of Fe and Os react with 1 : 2 : 3- (I), 1 : 2 : 4- (II), and 1 : 3 : 5-$C_6H_3(OH)_3$ (III) but (III) reacts only with Fe''' and Os^{8+}. In group V each isomeride appears to confine its reactions to a special region, (I) giving ppts. with Sb''' and Bi''', (II) giving unexpected changes depending on experimental conditions, and (III) giving colorations with As''', Sb''', and Sb'''''. In group IV there is no resemblance between the reactions of the three isomerides, (I) giving ppts. with Ce''', Ti''', and Ti'''', (II) yielding no reactions apart from a fugitive colour with Ce'''', with which (III) gives a ppt. (I) gives reactions with TiO_3', SnO_2'', Ta_6O_{19}'''''', and S'', (II) with IO_3', and (III) with NO_2' and BrO_3'. (I) only yields a ppt. with Sb but under the same conditions Bi also reacts. (I), (II), and (III) cannot be regarded as sp. reagents for Sb ions. With 2 : 3 : 7-trihydroxy-9-methyl-6-fluorone the ions of Fe and Os

give colorations whilst the cations $Ti^{\cdots}$, $Co^{\cdots\cdot}$, $Ge^{\cdots\cdot}$, $V^{\cdots}$, $As^{\cdots}$, $As^{\cdots\cdot}$, $Sb^{\cdots}$, $Sb^{\cdots\cdot}$, $Bi^{\cdots}$, $Mo^{\cdots\cdot}$, $W^{\cdots\cdot}$, and $V^{\cdots\cdot}$ give well-defined ppts. the colour of which varies between red-orange and red-brown. The production of these ppts. depends greatly on the acidity of the solution so that at p_H 4 the reagent may be regarded as sp. for Sb. Its use in the analysis of salts and alloys in macro- and micro-analytical practice is described in detail. Quantitatively difficulties are met in filtering the pptd. Sb complex and in freeing it from excess of the reagent by washing. H. W.

Determination of bismuth in medicines.—See B., 1937, 1406.

Determination of gold and silver by recovery of minute amounts from solution. W. E. Caldwell and K. N. McLeod (Ind. Eng. Chem. [Anal.], 1937, **9**, 530—532).—Details for the recovery of small amounts of Au and Ag from large vols. of liquid by collection with pptd. Hg–HgCl, cupellation, and parting with HNO_3 are given. The best reducing agent for producing the Hg–HgCl ppt. from aq. $HgCl_2$ is Mg + HCl or H_2SO_4. Good recovery of Au and Ag is also obtained by the addition of aq. NH_3 followed by aq. $HgNO_3$, when the Hg–$Hg(NH_2)\cdot NO_3$ ppt. collects these metals as it settles through the solution. The data given show that 0·01 mg. of Au or 1·0 mg. of Ag is recoverable from 40 litres of H_2O. The method has been applied to the control testing for $Ag^{\cdot}$ content in sterilised H_2O, and to the analysis of sea- and mine-H_2O and ore leach solutions for Au. L. S. T.

Microchemistry of the precious-metal elements. H. J. Fraser (Amer. Min., 1937, **22**, 1016—1034).—Reactions of Pt, Pd, Rh, Ru, Ir, Os, and Au with benzidine, $CS(NH_2)_2$, dimethylglyoxime, dimethylaminobenzylidenerhodanine, C_5H_5N,HBr, K Hg^{II} thiocyanate, $(NH_4)_2Cr_2O_7$, KI, NH_4Cl, and CsCl in the formation of cryst. ppts. examined under the microscope are described, together with the interferences that may be produced by one metal in presence of another. The mineralogy of these metals and the solubilities of their minerals in acids are discussed. The tests considered to be the most satisfactory for the identification of these metals in minerals are selected. L. S. T.

Analysis of platinum metals: silver assay bead.—See B., 1937, 1355.

Determination of osmium in a lead assay button.—See B., 1937, 1355.

Determination of specific heats by an eddy-current method. I. Theoretical. R. M. Davies and W. J. Thomas. **II. Experimental.** W. J. Thomas and R. M. Davies (Phil. Mag., 1937, [vii], **24**, 600—633, 713—744).—I. The sp. heats of metals and alloys, in cylindrical or sheet form, may be determined from a knowledge of the heating effect due to eddy currents produced by an alternating magnetic field. The necessary relationships are deduced.

II. A procedure for the determination of sp. heats is described. The sp. heats of Ni, Al, Cu, Fe, Sb, Bi, several alloys, and H_2O at 20° are given, with a max. error of 0·6%.

Precision thermostat, independent of surrounding temperature. B. Jelinek (Bull. Soc. chim., 1937, [v], **4**, 1811—1813).—With the regulator described it is possible to maintain the temp. of 45 litres of H_2O within about 0·001° for several days. E. S. H.

Spectro-analytical investigations with an interrupted arc of limited arc length. J. van Calker (Z. anorg. Chem., 1937, **234**, 179—188).—The advantages of limiting the arc length in an interrupted arc are discussed, and circuits for such an arc are considered. The effect of the sign of the electrodes on the spectrum is discussed. Almost all metals are more easily detected if the upper (pointed) electrode is the cathode, but As, P, La, and Li are more easily observed if it is made the anode. The variation of potential in a high-frequency self-maintaining interrupted arc without moving electrodes is compared with that of the ordinary rotating-electrode interrupted arc by an oscillograph method. A. J. M.

Two spectrometers for *X*-ray analysis. W. F. de Jong (Nature, 1937, **140**, 768). L. S. T.

Spectroscopic method for kinetic study of rapid chemical reactions. K. G. Stern and D. DuBois (J. Biol. Chem., 1937, **121**, 573—587).—An apparatus for recording the speed of fast reactions without intervention of electric or photo-electric instruments is described. The time of mixing when a solution of methylene-blue was injected into H_2O was 0·008 to 0·027 sec. Dissociation of human oxyhæmoglobin at p_H 8·6 and 28·5° was complete after approx. 0·08 to 0·12 sec. The rates of union of ferrihæmoglobin with H_2O_2, $EtCO_2H$, HCN, and HF at p_H 5·3 and 26—27°, and of catalase with the last three at p_H 6·9 and 26—28°, have been determined. J. N. A.

Mirror spectrograph of the observatory of the University of Leipzig. W. Lohmann (Z. Instrumkde., 1937, **57**, 124—129).—Apparatus is described. O. D. S.

Auto-collimating quartz spectrograph with long focal length. W. Herrmann (Z. Instrumkde., 1937, **57**, 21—24).—Apparatus is described. O. D. S.

Infra-red spectrometer making double use of the prism. W. Dahlke (Z. Instrumkde., 1937, **57**, 18—20).—Apparatus previously used (cf. A., 1936, 1318) is described. O. D. S.

(A) Methods of recording in infra-red spectroscopy. (B) Apparatus for measuring spectrograms. S. Fahrentholz (Z. tech. Physik, 1936, **17**, 67—68, 68—69; Chem. Zentr., 1936, i, 3871). H. J. E.

Means of increasing light transmitted by disappearing-filament pyrometer of precision. V. H. Stott (J. Sci. Instr., 1937, **14**, 370—372).—The circular diaphragm adjacent to the eyepiece is replaced by a slit, set parallel to the filament. J. S. A.

(A) Double grid valve in potentiometric analysis. (B) Potentiometric electrode and electrode-receptacle. R. Vanossi (Anal. Asoc. Quím.

Argentina, 1937, **25**, 54—71, 72—75).—A description of apparatus (cf. Hiltner, A., 1933, 362). F. R. G.

Relative efficiency of various types of counter-tubes for hard γ-rays. K. BUCHMANN (Physikal. Z., 1937, **38**, 817—824).—The efficiency of counter-tubes with walls of different materials (Pb, brass, Al) was investigated. For γ-rays from Th-*C*″ the efficiency was Pb 100, brass 78, Al 68. For hard Ra γ-rays, the ratio was Pb 100, brass 75, and for Ra γ-rays of approx. 0·6 M.c.v., Pb 100, brass 60. For Pb and brass an increase of 12—14% in efficiency can be achieved by roughening the inner surface of the tube. The optimum efficiency is obtained for Pb of thickness 0·65 mm. A. J. M.

Efficiency of counters and counter circuits. A. E. RUARK and F. E. BRAMMER (Physical Rev., 1937, [ii], **52**, 885; cf. A., 1937, 1, 582).—A correction. N. M. B.

Calculation of the grid temperature of electron tubes. S. WAGENER (Z. tech. Physik, 1937, **18**, 270—280).—The method previously described (Heinze and Wagener, B, 1937, 987) is applied to calculate grid temp. in multi-electrode tubes from cathode temp. Calc. vals. agree within 4% with experimental vals. obtained with tubes of a normal industrial type. O. D. S.

Photo-electric cells for measurement in the visible spectrum. P. GÖRLICH and W. LANG (Z. Instrumkde., 1937, **57**, 249—250; cf. A., 1936, 1223).—Photo-electric cells with combined Cs–Cs_2O–Ag and transparent Cs–Bi etc. cathodes have approx. uniform sensitivity throughout the visible spectrum. O. D. S.

Current stabiliser for electrolytic circuits. J. H. BRUCE and A. HICKLING (J. Sci. Instr., 1937, **14**, 367—370).—A simple thermionic valve circuit is described. J. S. A.

Hydrogen peroxide electrode. K. KODAMA and T. ONIZUKA (J. Biochem. Japan, 1937, **25**, 573—578).—The electrode (which appears to be of no practical val.) gives a relationship between potential (mv.) and p_H of $E = E_0 - 51{\cdot}8p_H$. F. O. H.

Vacuum titration. T. THUNBERG (Skand. Arch. Physiol., 1935, **72**, 291—294; Chem. Zentr., 1936, i, 4039).—A method of titrating from a burette into an evacuated vessel is described. It is suitable for determining ascorbic acid in juices. H. J. E.

Apparatus for the extraction of small quantities of liquid. H. K. BARRENSCHEEN (Mikrochim. Acta, 1937, **1**, 319—321).—The apparatus described extracts from 1 to 20 (max.) c.c. L. S. T.

New laboratory apparatus and application of porous glass filters. P. H. PRAUSNITZ (Chim. e. l'Ind., 1937, **19**, 569—574).—A description of laboratory apparatus made by the firm of Schott, Jena. O. J. W.

Laboratory circulating pump in glass. W. H. ALBRECHT (Chem. Fabr., 1937, **10**, 470).—A rotary pump with a capacity of 4 l. of H_2O per min. and a lift of approx. 2 m. is described. The use of glass throughout renders the pump suitable for corrosive liquids and relatively high temp. A. K. G. T.

Economical air compressor. H. W. BEAMS, A. T. CASTEEL, and R. L. KING (Science, 1937, **86**, 428).—The adaptation of a motor-car engine is described. L. S. T.

Calculation of surface tension from the measurement of sessile drops. A. W. PORTER (Phil. Mag., 1937, [vii], **24**, 823).—The correction table (A., 1933, 250) is amended. K. S.

Simple, accurate film balance of the vertical type for biological and chemical work, and a theoretical and experimental comparison with the horizontal type. Tight packing of a monolayer of ions. W. D. HARKINS and T. F. ANDERSON (J. Amer. Chem. Soc., 1937, **59**, 2189—2197).—The procedure involves the use of the Wilhelmy method for the determination of surface tension in a proper differential form, making use of the balance between the vertical pull of the surface tension directed downward and the vertical upward force of buoyancy of the liquid. Advantages of the apparatus are described. The mathematical theory of the "horizontal-pull" film balance is developed, and it is shown that the two types give essentially the same vals. of surface pressure with liquid or solid films. A study of the effect of $Ca^{\cdot\cdot}$ on films of stearic acid shows that $Ca^{\cdot\cdot}$ compresses the fatty acid ions of the film and eliminates the expanded region obtained without it. E. S. H.

Practical needle valve for vacuum apparatus. W. VON MEYEREN (Z. tech. Physik, 1937, **18**, 281).—A reducing valve for gas inlet is described. O. D. S.

Study of gases. M. W. TRAVERS (J. Inst. Fuel, 1937, **11**, 17—25).—The technique and some of the results of the author's experimental study of the thermal decomp. of C_2H_6, C_3H_8, and MeCHO are described (cf. A., 1935, 40; 1936, 309; 1937, 1, 34). A. B. M.

Non-corrodible [glass] circulating device. K. A. FREEMAN and P. J. THOMPSON (Ind. Eng. Chem. [Anal.], 1937, **9**, 532).—The apparatus described can be used for circulating liquids, as a sampling device for solutions or suspensions, and for circulating an electrolyte through a cell. L. S. T.

Piezometer ring. C. P. BAKER and A. J. KOMICH (Ind. Eng. Chem. [Anal.], 1937, **9**, 533). L. S. T.

Determination of specific gravity. E. A. SIEBEL and A. E. KOTT (J. Assoc. Off. Agric. Chem., 1937, **20**, 535—542).—In order to avoid the continual reweighing of the pyknometer necessitated by variation in atm. pressure and temp., a counterweight of vol. = that of the pyknometer is employed. A simplified method of calculation is described. E. C. S.

New capillary phenomenon and its use, especially for micro-manometric measurements. E. RÖBBELEN (Z. tech. Physik, 1936, **17**, 95—98; Chem. Zentr., 1936, i, 4038). H. J. E.

Simple manometer for measuring low pressures. J. NIKLIBORC (Acta phys. polon., 1935, **4**, 85—96; Chem. Zentr., 1936, i, 3870).—The damping of the vibration of a 4·5-mm. Ni-coated and

polished Fe plate suspended by a quartz fibre is measured. H. J. E.

Quartz manometer for the static measurement of vapour tensions of fused salts. W. JAHN-HELD and K. JELLINEK (Z. Elektrochem., 1937, **43**, 491—496).—Pb is used as manometer liquid for 330—800° and Ag for temp. above 960°; the construction and standardisation of the instrument are described. The results obtained for the vapour tension of $PbCl_2$ at 752—903° and for $PbBr_2$ at 772—880° were in close agreement with data found in the literature. A. R. P.

Highly polymerised compounds. CLX. Applicability of the Ostwald viscosimeter to the determination of high mol. wts. G. V. SCHULZ (Z. Elektrochem., 1937, **43**, 479—485).—In determining η for solutions of, *e.g.*, cellulose nitrate in $COMe_2$ or polystyrene in PhMe the diameter and length of the capillary should be so adjusted that 0·5—1 c.c. of the solvent alone passes through in 100 sec. so as to reduce the Hagenbach correction to <1%. The results thus obtained are in good agreement with those obtained with the Ubbelohde viscosimeter. A. R. P.

Simple overflow viscosimeter and its use in determining the solvent power of organic liquids for cellulose esters. I. SAKURADA and N. SAITO (Kolloid-Z., 1937, **81**, 208—212).—The instrument is constructed so that, when successive additions are made to the liquid under examination, the lower level remains unchanged. F. L. U.

Sedimentation analysis. E. HOFFMANN (Österr. Chem.-Ztg., 1937, **40**, 476—479; cf. A., 1937, I, 374).—Methods of determining particle size in suspensions are discussed. The theory is developed for the method involving centrifuging for various times, followed by determination of the particle distribution at various levels. J. W. S.

Analytical measurements of ultracentrifugal sedimentation. A. TISELIUS, K. O. PEDERSEN, and T. SVEDBERG (Nature, 1937, **140**, 848—849).—A new quant. procedure is described. The centrifuged solution is separated into two portions in a modified cell and from the change in the amount of the sedimenting component in the layers the sedimentation const. can be calc. The method is of special importance in the study of enzymes and antibodies. L. S. T.

Geochemistry.

Analysis of the sulphurous water of the "Pergoli" spring of Tabiano (Parma). G. ILLARI (Annali Chim. Appl., 1937, **27**, 444—456).—Chemical and physico-chemical analyses are given. The H_2O has a strong odour of H_2S, deposits S when kept in air, is radioactive, and contains chiefly $Na^{\cdot}$, $Ca^{\cdot\cdot}$, $Mg^{\cdot\cdot}$, Cl', SO_4'', HS', and HCO_3' ions, SiO_2, and dissolved H_2S and CO_2. L. A. O'N.

Thermal waters of the Ailet region (Eritrea). C. TOFFOLI (Annali Chim. Appl., 1937, **27**, 165—174).—Chemical and other properties are recorded. The waters are hyperthermal, soft, rich in SiO_2, radioactive, and contain mainly alkali H carbonates. O. J. W.

Thermal water of Ali-Hasa (Eritrea). C. TOFFOLI (Annali Chim. Appl., 1937, **27**, 175—178).—This H_2O is very similar to those described in the preceding abstract. O. J. W.

Carbonate mineral water from the air-port of Ciampino (Rome). M. TALENTI (Annali Chim. Appl., 1937, **27**, 207—209).—Chemical analyses and other data are recorded. O. J. W.

Enrichment of heavy water in glacial ice. A. EUCKEN and K. SCHÄFER (Nachr. Ges. Wiss. Göttingen Math.-phys. Kl., III, 1935, **1**, 137—146; Chem. Zentr., 1936, i, 3961; cf. A., 1936, 1226).—Earlier results are confirmed and amplified. H. J. E.

Plantersville meteorite, Grimes County, Texas. J. T. LONSDALE (Amer. Min., 1937, **22**, 877—888).—The meteorite consists of hypersthene and a monoclinic pyroxene 40%, chrysolite 30%, metal 19%, troilite 5%, glass 5%, and traces of a brown spinel and chromite (?). Chemical analyses [F. A. GONYER] of the metallic portion, the sol. silicates and sulphides, and the insol. silicates are given. The composite analysis is SiO_2 35·87, Al_2O_3 2·18, FeO 12·10, MgO 23·57, CaO 1·97, Na_2O 1·05, K_2O 0·12, P_2O_5 0·05, Cr_2O_3 0·03, MnO 0·18, TiO_2 none, NiO 0·01, CoO none, S 1·45, Fe 16·99, Ni 1·92, Co 0·06, Cu trace, P trace, total 97·55%. A spectrographic analysis [H. C. WILHELM] showed the presence of Ge and Ti in addition. L. S. T.

Labile equilibria in the field of crystallisation of astrakhanite. V. I. NIKOLAEV, E. E. BUROVAJA, and N. I. ROSTOVTZEVA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 681—695).—Crystallisation of astrakhanite takes place most readily from solutions saturated with respect to NaCl and $MgSO_4$ but with a low $MgCl_2$ content. R. T.

Occurrences of kaolinite deposited from solution. W. A. TARR and W. D. KELLER (Amer. Min., 1937, **22**, 933—935).—Three such occurrences in small, white crystals are reported from Oronogo, Missouri; Henley, Missouri; and Keokuk, Iowa. L. S. T.

Unusual occurrence of halite. K. SPIROFF (Amer. Min., 1937, **22**, 931—933).—Halite occurs as stalactites, stalagmites, and encrustations in the Quiney Mine, Hancock, Michigan. L. S. T.

Petrologic results of a study of the minerals from the Tertiary volcanic rocks of the San Juan Region, Colorado. E. S. LARSEN, J. IRVING, F. A. GONYER, and E. S. LARSEN 3rd. (Amer. Min., 1937, **22**, 889—905; cf. A., 1937, I, 102).—The occurrence, resorption, and conditions of formation of the amphiboles are described. Chemical analyses of three and optical properties of seven amphiboles from this

region are recorded. A similar study for biotite has been made. Chemical analyses and optical properties of four biotites from these lavas are recorded. Conditions favouring the formation of Fe_2O_3-rich hornblende and biotite are probably represented by $2FeO + H_2O \rightleftharpoons Fe_2O_3 + 2H$. L. S. T.

Lopezite, a new mineral. M. C. BRANDY (Amer. Min., 1937, **22**, 929—930).—Lopezite, α 1·714, β 1·732, γ 1·805, occurring at Maria Elena, near Tocopilla, has properties practically identical with those of artificial $K_2Cr_2O_7$. L. S. T.

Optical properties and chemical composition of glaucophane. H. W. V. WILLEMS (Proc. K. Akad. Wetensch. Amsterdam, 1937, **40**, 720—724).—The approx. composition of a glaucophane can be predicted from its optical properties. A. J. E. W.

Rôle of physical chemistry in stratigraphic problems. G. R. MANSFIELD (Econ. Geol., 1937, **32**, 533—549).—The need for the application of physico-chemical methods to the problems of stratigraphy is illustrated by a consideration of the phosphate beds and bedded cherts of the Phospharia formation in Idaho and of the K-bearing Salado halite in New Mexico and Texas. L. S. T.

Dynamic metamorphism of a pegmatite. J. L. LINDNER (J. Geol., 1937, **45**, 558—563).—A soda-pegmatite on the east shore of the Herman Lake, Ontario, has been metamorphosed in part to a schist. Mineralogically, the chief difference has resulted from addition of chlorite. The chemical analyses recorded show additions of H_2O, MgO, and FeO, and losses of alkalis, CaO, Al_2O_3, and SiO_2. L. S. T.

Formation of laterite. D. W. BISHOP (Geol. Mag., 1937, **74**, 442—444).—A discussion. L. S. T.

Composition and structure of stilpnomelane. J. W. GRUNER (Amer. Min., 1937, **22**, 912—925).—Chemical analyses selected from the lit. and a new analysis of the mineral from Baern give the formula $(OH)_{16}(K,Na,Ca)_{0-2}(Fe,Mg,Al)_{29}Si_{32}O_{93},13H_2O$. Except for the state of oxidation of the Fe, chalcodite is the same chemically and structurally as stilpnomelane (I). Dehydration in a vac. shows that $\frac{1}{3}$ to $\frac{2}{5}$ of the total H_2O in (I) is present as OH. This is not given off below 500°. Dehydration is complete at 750°. The structure collapses completely between 600° and 650°. Fe is not oxidised during dehydration at the higher temp. *X*-Ray data give $d_{(001)}$ 12·07—12·18 A., b_0 9·08—9·12 A., a_0 5·23—5·27 A. The structure probably consists of pyrophyllite-talc layers spaced 12·1 A. apart. The space between them contains ions of Fe, Mg, and K which cannot be accommodated in the layers. A corresponding no. of O or OH ions must be present between the layers. The result is a defect structure in which ions may occupy random positions. K is partly replaced by Tl when (I) is boiled in aq. $TlNO_3$. (I) heated with 0·1N-HCl, but not with 0·03N-HCl, in Au-lined bombs at 300° changes to a true pyrophyllite structure. L. S. T.

Magnetic behaviour of the dolerite intrusions in the Karroo system and magnetic measurements on the Witwatersrand. G. BEYER and R. KÜHNE (Metall u. Erz, 1937, **34**, 471—475). A. R. P.

Crystalline structure and decomposability of Greek bauxite. A. A. DELYANNIS and K. ALEXOPOULOS (Metall u. Erz, 1937, **34**, 466—467).—The Al_2O_3 readily sol. in hot aq. NaOH is present as böhmite, whereas that insol. is present as diaspore. A. R. P.

Mongolian magmas. G. W. BAIN (Bull. Geol. Soc. Amer., 1935, **46**, 1745—1813).—The rocks are described, 46 analyses being recorded. CH. ABS. (*e*)

Scheelite-leuchtenbergite vein in Paradise range, Nevada. P. F. KERR and E. CALLAGHAN (Bull. Geol. Soc. Amer., 1935, **46**, 1957—1974).—It is believed that the scheelite is residual and that the original quartz matrix has been replaced by talc and leuchtenbergite due to hydrothermal action. CH. ABS. (*e*)

Petrography and genesis of the Siwalik series [N. W. India]. P. D. KRYNINE (Amer. J. Sci., 1937, [v], **34**, 422—446).—These fluvial sediments consist of (i) medium-grained sandstones and graywackes containing approx. 40% of quartz, 15% of felspar, 6% of mica (mainly biotite), and 30—40% of metamorphic rock fragments, and (ii) fine-grained red mudstones, siltstones, and subordinate shales. Minerals present are recorded, and conditions of deposition discussed. The Murree sediments consist mainly of fine-grained brick-red or maroon sandstones containing a large proportion of schist fragments. L. S. T.

Graftonite from Greenwood, Maine. J. J. GLASS and J. J. FAHEY (Amer. Min., 1937, **22**, 1035—1039).—Graftonite from Noyes Mountain, Greenwood, Maine has α 1·709, β 1·714, and γ 1·733. The chemical analysis [J. J. FAHEY] gives an isomorphous variation in the proportions of Fe, Mn, and Ca, but conforms to the established formula of $3(Fe,Mn,Ca)O,P_2O_5$. L. S. T.

Rare-alkali biotite from Kings Mountain, N. Carolina. F. L. HESS and R. E. STEVENS (Amer. Min., 1937, **22**, 1040—1044).—Brown mica associated with a pegmatite at Ware farm, King's Mountain, N. Carolina, has Si 42·02, Al_2O_3 18·75, Cr_2O_3 n.d., Fe_2O_3 0·66, FeO 8·29, MnO 0·27, MgO 9·55, CaO 0·93, Li_2O 1·20, Na_2O 0·73, K_2O 8·54, Rb_2O 1·85, Cs_2O 0·47, H_2O- 0·16, H_2O+ 2·44, TiO_2 1·35, F 4·34, total 101·55, less O for F 1·83, total 99·72%. An analysis of biotite from near Tin Mountain, S. Dakota, is also recorded. L. S. T.

Contemporaneous crystallisation of beryl and albite versus replacement. B. M. SHAUB (Amer. Min., 1937, **22**, 1045—1051).—The beryl-albite intergrowths occurring at the Golding-Keene, New Hampshire, and the Strickland Connecticut, felspar mines show relationships that indicate a contemporaneous crystallisation and not an origin through processes of replacement. L. S. T.

Hilgardite, a new mineral species, from Choctaw Salt Dome, Louisiana. C. S. HURLBUT, jun., and R. E. TAYLOR (Amer. Min., 1937, **22**, 1052—1057).—*Hilgardite* (I) is found associated with

anhydrite, danburite, boracite, etc. in the insol. residue from a brine well in this dome. (I), *d* 2·71, hardness 5, is monoclinic-domatic with $a:b:c$ 1·0147 : 1 : 0·5585, β 90° 00′, colourless with a vitreous lustre, n_X 1·630, n_Y 1·636, n_Z 1·664. The analysis [F. A. GONYER] is CaO 34·41, B_2O_3 49·18, H_2O 6·31, Cl 10·37, insol. 1·89, total 102·16, less O for Cl 2·34, total 99·82%, giving the formula $Ca_8(B_6O_{11})_3Cl_4,4H_2O$. A Weissenberg study gives a_0 11·85, b_0 11·12, c_0 6·20 A., vol. of unit cell 786 A.^{3}, and mol. wt. of unit cell 1290; space-group *Pc* or *Pm*. L. S. T.

Massive low-fluorine topaz from the Brewer Mine, S. Carolina. J. T. PARDEE, J. J. GLASS, and R. E. STEVENS (Amer. Min., 1937, **22**, 1058—1064).—Topaz of a fine-grained chert-like character forms a large part of the Au-bearing lode at this mine. The large size and low F content make this deposit unique. The massive topaz has SiO_2 33·00, Al_2O_3 56·76, Fe_2O_3 trace, H_2O- 0·04, H_2O+ 2·67, F 13·23, total 105·70, less O for F 5·57, total 100·13%, d^{25} 3·509±0·001, *n* 1·631, α 1·629, β 1·631, γ 1·638. The F and H_2O contents are the lowest and highest, respectively, on record. The uniformity in optical properties of the massive, granular, and disseminated topaz from different parts of the mine indicates a common origin. Previously existing rocks of the area apparently reacted with magmatic solutions rich in F, SiO_2, and sulphides, and deficient in alkalis, and were replaced by topaz, quartz, and small amounts of sulphides. L. S. T.

[Occurrences of] tellurium minerals in New Mexico. W. P. CRAWFORD (Amer. Min., 1937, **22**, 1065—1069).—Descriptive. L. S. T.

Colour change and absorption of zircon from Mongka, Upper India. K. CHUDOBA and T. DREISCH (Zentr. Min., 1936, **A**, 65—79; Chem. Zentr., 1936, i, 3993; cf. A., 1937, I, 204).—The changes in infra-red spectrum show that the colour change is due to decomp. of Fe^{III} compounds. H. J. E.

Crystallisation of pyroxene and hornblende from artificial silicate melts. D. P. GRIGORIEV and H. W. ISKÜLL (Zentr. Min., 1936, **A**, 82—87; Chem. Zentr., 1936, i, 3993; cf. A., 1937, I, 204).—From a melt of CaF_2, MgO, and SiO_2 (1 : 1 : 2) pyroxene crystallises together with hornblende. H. J. E.

Mechanism of the dehydration of zeolites. W. O. MILLIGAN and H. B. WEISER (J. Physical Chem., 1937, **41**, 1029—1040).—*X*-Ray diffraction study and dehydration isobars at 23·6 mm. obtained under conditions used previously (A., 1937, I, 527) show that scolecite is a trihydrate giving a dihydrate; natrolite a dihydrate giving a monohydrate; mesolite a mixture of these. In stilbite, heulandite, thomsonite, analcite, and chabazite the H_2O is bound by adsorption forces within the lattice channels. Hence the term " zeolitic water " has no special meaning. F. R. G.

Sedimentary and petrographic study of certain glacial drifts of Minnesota. F. C. KRUGER (Amer. J. Sci., 1937, [v], **34**, 345—363).—The distributions of heavy minerals in the various drifts are tabulated. The Wisconsin Red drift is high in augite and magnetite, whilst the Illinoian Red drift has abundant limonite. Garnet, hornblende, and apatite are prominent constituents of the Wisconsin Gray, Kansan Gray, and Iowan drifts; abundant micaceous minerals are also a characteristic. These drifts can be separated on the basis of their carbonate content (data for extraction with dil. HCl given). The amounts of sol. carbonates and the assemblage of heavy minerals are correlated with the origin of a drift. L. S. T.

Calcite from the Madonna del Carmine [hill] of Dorgali, [Sardinia]. C. LAURO (Atti R. Accad. Lincei, 1937, [vi], **26**, 25—28).—A crystallographic description of the calcite crystals found in the basaltic lava. O. J. W.

A singular rock from the Baltoro glacier (Karakorum). I, II. P. COMUCCI (Atti R. Accad. Lincei, 1937, [vi], **25**, 648—651, 734—738).—Three samples of a felspar from this source are described and their composition is given. O. J. W.

Microscopic study of goethite and hæmatite in the brown iron ores of E. Texas. F. W. GALBRAITH (Amer. Min., 1937, **22**, 1007—1015).—The Fe oxide minerals consist of approx. 80% of goethite (I) and 20% of hæmatite (II). Lepidocrocite is absent. Quartz is the predominant impurity, but is not abundant. (I) and (II) are essentially contemporaneous; both appear to have been deposited at ordinary temp. and there has been little, if any, alteration of one into the other. L. S. T.

Chemical composition of the iron ores of the U.S.S.R. A. D. ARCHANGELSKI and E. V. KOPTSCHENOVA (Trans. Sci. Inst. Geol. Min. U.S.S.R., 1935, No. 11, 5—66).—Data for the distribution of P, Mn, Ti, V, As, Cr, Ni, Co, and Cu in sedimentary Fe ores are recorded and discussed. CH. ABS. (*e*)

Structure of Norwegian ores. M. MORTENSON (Tids. Kjemi, 1937, **17**, 131—134).—The microcryst. structure of pyrites ores containing ZnS has been studied. The presence of magnetite indicates that the original magma contained an excess of Fe, which would tend to replace Zn in the Zn blende. This is confirmed by the difficulty of separating Zn by flotation in ores containing magnetite. M. H. M. A.

Morenosite from Val Malenco. A. CAVINATO (Atti R. Accad. Lincei, 1937, [vi], **25**, 399—401).—The green incrustations on the serpentine masses in the Val Malenco appear to consist of an impure morenosite containing some Mg. O. J. W.

Formation of gneisses and granulites containing sillimanite in the French Massif Central. H. LONGCHAMBON (Compt. rend., 1937, **205**, 567—569). A. J. E. W.

Cairnsmore of Fleet granite and its metamorphic aureole. C. I. GARDINER and S. H. REYNOLDS (Geol. Mag., 1937, **74**, 289—300).—An analysis of a biotite- and of a muscovite–biotite-granite are given. L. S. T.

Anthophyllite-cordierite-granulites of the Lizard. C. E. TILLEY (Geol. Mag., 1937, **74**, 300—309).—Petrological. L. S. T.

[Physical] disintegration of radioactive minerals. E. Føyn (Tids. Kjemi, 1937, **17**, 126).—Autoclaving of cleveite with H_2O for 6 hr. at 190° gives a disintegration product of the same composition as the original mineral, whereas bröggerite (12 hr. at 300°) gives a product rich in Pb and Fe, but containing no U, Th, or Ra. No dissolution occurred in either case. It is concluded that a high $UO_2 : UO_3$ ratio favours decomp. M. H. M. A.

Determination of uranium, thorium, and lead in thucholite.—See A., I, 46.

Carbon dioxide accumulations in geologic structures.—See B., 1937, 1200.

New Vogtland wolframite deposit at Pechtelsgrün near Lengenfeld. F. Wernicke and E. O. Teuscher (Z. deut. Geol. Ges., 1936, **88**, 87—104; Chem. Zentr., 1936, i, 4275).—Geological and petrological characteristics of the deposit are discussed. J. S. A.

Origin of the Thüringian Bunter Sandstone. R. Söfner (Chem. Erde, 1937, **11**, 420—444).—Origin and structure are discussed. L. S. T.

Attapulgite. J. de Lapparent (Z. Krist., 1937, **97**, 237—239).—A reply to Kerr (A., 1937, I, 484). Identity of attapulgite (I) with montmorillonite (II) is refuted by thermal and dehydration curves, and by chemical, structural, and X-ray evidence. (I) has a mica, (II) a chlorite, structure. The long-spacing difference of 4 A. is due to the brucite layer in (II) of Si surrounded by OH′ which is destroyed at 300°. I. McA.

Crystallography of brushite. P. Terpstra (Z. Krist., 1937, **97**, 229—233).—The monoclinic cell of $CaHPO_4,2H_2O$ contains 8 mols. and has a 10·3, b 15·4, c 6·4 A., β 84° 53′; probable space-group C_2^3; d 2·326. Optical, goniometric, and X-ray measurements confirm the close analogy with the isomorphous gypsum (A., 1937, I, 17). The $PO_3{\cdot}OH$ groups in brushite occupy the SO_4 positions in gypsum. P lies inside a distorted tetrahedron bearing O ions at its corners with H′ at the middle of one edge, the PH′ line forming a dyad axis. I. McA.

Isomorphous kerolite–beidellite series in clay silicates. D. P. Serdiutschenko (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 355—358).—Isomorphous exchange of $3MgO–Al_2O_3$ in the forms $3MgO,3SiO_2,4{\cdot}5H_2O–Al_2O_3,3SiO_2,5H_2O$ applied to published chemical analyses for the reddish soapy mineral from Montmorillon (France) shows that it consists of montmorillonites or of members of the kerolite–beidellite series. The higher SiO_2 content of the similar mineral from Rhön basalts is due to isomorphous addition of montmorillonite. The results accord with the nature, formation, and X-ray analyses of the minerals. I. McA.

Behaviour of montmorillonite on wetting. W. F. Bradley, R. E. Grim, and G. L. Clark (Z. Krist., 1937, **97**, 216—222; cf. A., 1936, 1450; 1937, I, 17).—A Wyoming bentonite (montmorillonite) of stated air-dried composition is grained to 0·05—0·1 μ. and X-rayed in oriented sheets at various humidities, the H_2O content being determined by ignition. Swelling is not continuous. The (001) spectra indicate five definite hydrates $P,6nH_2O$ ($n = 0$—4, P = pyrophyllite) of cell heights 9·6, 12·4, 15·4, 18·4, 21·4 A., respectively. A structure is assigned in which the 2 H_2O of P occur as OH associated with the terminal Al_2O_3 octahedra, and the 6 H_2O enter successively as hexagonally-packed layers, 3A. thick, between the internal O layers; it explains the (001) spacings and intensities, especially the marked line at about 3·1 A., and provides a mechanism in layer mobility for easy base exchange. I. McA.

Carbonate-apatites. Structure of francolite. J. W. Gruner and D. McConnell (Z. Krist., 1937, **97**, 208—215; cf. A., 1934, 157).—Chemical analyses, and indexed spacings of estimated intensity from a powder X-radiogram, are listed for francolite, the hexagonal unit cell of which has a 9·34±0·01, c 6·88±0·01 A., $d_{pyk} = 3{\cdot}147$. Assuming the Mehmel fluorapatite structure, at. exchange is discussed. The C ion cannot occupy the F positions. As CO_3, some C replaces Ca, contrapolarisation by adjoining P ions expanding the CO_3 radical; as CO_4, the main part replaces P, decreasing the positive charges sufficiently to permit replacement of O by OH and excess F. The carbonate-apatite group structure is thus: $[Ca(F,Cl,OH)](Ca,C)_4[(P,C)(O,OH,F)_4]_3$. I. McA.

Photolytic neutralised elements of fluorite. J. Hoffmann (Chem. Erde, 1937, **11**, 368—374).—White fluorite from Fürstenberg when exposed to Ra became blue and this colour disappeared in a few sec. on exposure to light. Tho coloured material, powdered in the dark, gave an alkaline reaction. Prepared CaF_2 did not show this effect. The colour is due to free Ca atoms, and not to Ce oxides. Dark violet fluorite from deposits containing U minerals is strongly alkaline. Differences in odour noticed when this material is powdered are due to F_2, HF, and O_3 (the last two formed by the action of F_2 on traces of H_2O). L. J. S.

Pneumatolytic and hydrothermal alteration and synthesis of silicates. G. W. Morey and E. Ingerson (Econ. Geol., 1937, **32**, 607—761 Suppl.).—A review. Available data relating to hydrothermal and pneumatolytic syntheses of silicates are assembled. An annotated bibliography is given. L. S. T.

Sedimentary petrography of the Upper Pliocene and Lower Pleistocene of the middle Upper Rhine plain. K. H. Sindowski (Z. deut. Geol. Ges., 1937, **89**, 409—418).—Heavy mineral analyses are recorded and discussed. L. S. T.

Carotene (provitamin-A) in sapropel. B. K. Klimov and E. I. Kazakov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 321—323).—Marsh sapropels contain from 10 to 20 mg. of carotene per 100 g. of dry substance. Lake sapropels contain smaller amounts. F. J. G.

Germaninm and gallium in coal ash and flue dust.—See B., 1937,1291.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

FEBRUARY, 1938.

Stark effect in hydrogen and deuterium. J. S. FOSTER and H. SNELL (Proc. Roy. Soc., 1937, **A**, **162**, 349—356).—The observed asymmetric Stark intensity patterns for D are nearly mirror images of those for H. Variations from the Epstein spacing of components are found to be in fair agreement with the Schlapp theory of fine structure. A novel form of canal-ray tube is described. G. D. P.

Excitation of light by canal rays from hydrogen and deuterium. R. JUNKELMANN (Z. Physik, 1937, **107**, 561—578).—Measurements of the excitation of He, A, and H_2 by canal rays from H and D with energies between 8 and 50 kv. are reported. Excitation of the He line λ 3888 shows a sharp rise in intensity which occurs at a lower energy but higher velocity with H atoms than with D atoms. This agrees with deductions made by Döpel from other canal-ray measurements. Excitation of A and H_2 lines show intensity maxima also produced at a lower energy but higher velocity by H atoms than by D atoms. The excitation of H_γ and D_γ produced by the collisions was measured. The kinetics of the collisions involved are examined and results discussed on the basis of Döpel's models. H. C. G.

Excitation of potentials of the levels $B_3\Pi$ and $C_3\Pi$ of the nitrogen molecule. R. BERNARD (Compt. rend., 1937, **205**, 793—794).—The $2P$ and $1P$ bands of N_2 are easily excited by electrons of energies <12 and 10 e.v., respectively, in presence of He and Ne, results which cannot be obtained with pure N_2. By extrapolation it is inferred that the excitation potentials of the $B_3\Pi$ and $C_3\Pi$ levels are respectively approx. 7·5 and 11 e.v. R. S. B.

Energy levels of neon and argon. J. B. SAMPSON (Physical Rev., 1937, [ii], **52**, 1157—1158; cf. Shortley, A., 1933, 1226; A., 1935, 556).—The energy levels for the Ne $2p^53d$ and A $3p^55d$ configurations have been calc. from the first-order perturbation theory and compared with observed vals. N. M. B.

Spectrum of silicon. T. TAKAMINE, T. SUGA, and M. KAMIYAMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, **33**, 247—271).—Full data are given and discussed for part of the Si spectra in the extreme ultra-violet, 1300 to 150 A., at successive stages of ionisation when a strong condensed discharge is passed through a fine quartz capillary in H_2 at low pressure. The change of many Si I and Si II lines from emission to absorption with increased spark energy, and the marked difference in ease of reversal for different Si II lines were observed. The relation between stellar temp. classification and the temp. of the experimental light source is discussed. N. M. B.

Low terms in Cr III, Cr IV, Mn IV, and Fe V. I. S. BOWEN (Physical Rev., 1937, [ii], **52**, 1153—1156; cf. A., 1935, 1045).—Extensive data and classifications of the strong lines arising from the d^3, d^24s, and d^24p configurations of Cr IV, and the d^4, d^34s, and d^34p configurations of Cr III, Mn IV, and Fe V are tabulated. The presence of forbidden lines of these ions in astronomical sources is discussed. N. M. B.

Stark effect in iron and the contrast with pole effect. S. F. PANTER and J. S. FOSTER (Proc. Roy. Soc., 1937, **A**, **162**, 336—348).—A discharge tube suitable for investigation of the Stark effect in the spectra of metals of high m.p. is described. Of over 200 lines of the Fe spectrum recorded photographically, 33 were found to be displaced by fields up to 150 kv. per cm., 8 towards the red and 25 towards the violet. It is concluded that the pole effect, *i.e.*, a change of λ at the pole as compared with the centre of the arc, is not identical with the Stark effect. The Stark displacements of lines not yet examined are predicted. G. D. P.

Hyperfine structure in [the spectrum of] germanium. L. SIBAIYA (Current Sci., 1937, **6**, 152).—The seven arc lines studied are single, showing the absence of isotope displacements in the levels examined, and indicating that the ^{73}Ge nucleus has a very small magnetic moment. A. J. E. W.

Absorption spectrum of liquid bromine. D. PORRET (Proc. Roy. Soc., 1937, **A**, **162**, 414—419).—The absorption of liquid Br has been investigated between 20,000 and 40,000 cm.$^{-1}$ by a method for which increased accuracy is claimed. The extinction coeff. curve is compared with those of gaseous Br and a solution of Br in CCl_4. The observed differences are discussed. G. D. P.

Pressure effects of rare gases on the second doublet of the rubidium principal series. N. T. ZÉ and C. S. YI (Physical Rev., 1937, [ii], **52**, 1158—1161).—The displacement, asymmetry, and broadening of the second doublet of the Rb principal series perturbed by He, Ne, and A up to 13 atm. were investigated. Results are compared with those for K and Cs (cf. Watson, A., 1934, 1) and discussed in relation to Margenau's theory of pressure effects of foreign gases on spectral lines. N. M. B.

First spark spectrum of indium, In II. F. PASCHEN and J. S. CAMPBELL (Ann. Physik, 1938, [v], **31**, 29—75).—The hyperfine structure has been

measured and analysed from 9246 to 2078 A. λλ are tabulated. O. D. S.

Influence of addition of gas and of a magnetic field on the degree of polarisation of fluorescence of iodine vapour. M. S. Mrozowski (Bull. Acad. Polonaise, 1937, **A**, 295—311).—The degree of polarisation of fluorescence of I vapour admixed with He, Ne, A, N_2, and H_2 (p, 0—30 mm.) has been determined using Al–Cd spark λλ 3200, 3460, and 4400 A. (unpolarised) and Hg arc λ 5461 A. (polarised) as exciting radiations. The influence of the variation of the life period of the excited mol. is investigated by repeating measurements in a magnetic field (22,000 gauss) and corrections for this variation are calc. The mechanism of depolarisation of fluorescence by collision is discussed. F. J. L.

Nuclear moment of barium. A. N. Benson and R. A. Sawyer (Physical Rev., 1937, [ii], **52**, 1127—1131).—In view of discordant reported vals. for the nuclear moment of the odd isotopes of Ba, new data on the hyperfine structure of several lines were obtained. Investigations of the separation of the $6^2S_{\frac{1}{2}}$ and $7^2S_{\frac{1}{2}}$ components from the centre of gravity, and of the spacing and patterns of the 5^3D_3 and 6^3P_2 terms, indicate the val. $I = 1\frac{1}{2}$ for the nuclear moment. N. M. B.

Probability of stepwise excitation of mercury atoms. V. Fabbikant and I. Cirg (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 263—266).—The mechanism by which excited Hg atoms are excited to higher levels by electron impacts is investigated by measurement of the radiation intensity from Hg vapour at const. v.p. (10^{-3} mm. Hg) and various electron concns. $Q_a(V_{ma})$, the effective section of excited atoms at the max. of the function of excitation, is 16 cm.^{2}/cm.^{3} When atoms obey the Boltzmann distribution law the excitation of the upper levels is stepwise. F. J. L.

Intensity ratios of some intercombination lines in the mercury spectrum. J. L. Verhaeghe (Bull. Acad. roy. Belg., 1937, [v], **23**, 790—799).—Calculations of the intensity ratios of lines 6716, 6234, 5803, 5549 with intercombination lines 6072, 5676, 5316, 5102 from the same upper electron level by the method of Wolfe gave results quite different from the theoretical; deviations are not explained by reabsorption. S. C.

Recombination in the afterglow of a mercury discharge. F. L. Mohler (J. Res. Nat. Bur. Stand., 1937, **19**, 559—566; cf. A., 1938, I, 2).—The ionic density and ionic current to the wall of the bulb have been determined at various brief intervals after cutting off a Hg-arc discharge (4 or 6 amp. in a 500-c.c. bulb; v.p. of Hg $2{\cdot}7 \times 10^{-4}$ mm.) by short-circuiting two anodes. The recombination coeff. is $2{\cdot}3 \times 10^{-10}$, and the electron temp. decreases with time from 3000° K. at 10^{-3} sec. to 1600° K. at 6×10^{-3} sec. It is inferred that the reaction is probably not a spontaneous two-body recombination. J. W. S.

Longitudinal field strength of the positive column in the low-pressure discharge in gas mixtures at varying current strengths and pressures. H. Alterthum and A. Lompe (Ann. Physik, 1938, [v], **31**, 1—28).—The longitudinal field strength X in the positive column has been measured by means of a probe method in an a.c. discharge in mixtures of Ne and A, containing 0—50% A, at pressures from 2 to 10 Torr and currents from 10 to 200 ma. The addition of A to Ne causes a decrease in X and an alteration in the form of the curve of X against current. O. D. S.

Temperature rise in the dark space of the glow discharge. A. Günther-Schulze and W. Bär (Z. Physik, 1937, **107**, 642—652).—With A in a discharge vessel consisting of plane electrodes separated by a glass ring, the mean max. rise in temp. was found to be about 10°. This indicates that only a very small fraction of the energy dissipated at the cathode is conveyed to the gas, which is heated mainly by electron impact. The implications of this result are discussed. H. C. G.

Effect of a magnetic field on the electrodeless high-frequency discharge. E. W. B. Gill (Nature, 1937, **140**, 1061). L. S. T.

Photographic study of the vacuum spark discharge. J. A. Chiles (J. Appl. Physics, 1937, **8**, 622—626).—Vac. spark discharges between several metallic electrodes have been photographed. Except in the case of Sn, luminosity appears first at the anode; the time interval is of the order of 10^{-8} sec. When the potential is first applied there is a pure electron discharge which vaporises the anode by bombardment and gives rise to a cloud of ions; these after an initial field acceleration recombine and continue across the gap, the luminosity being caused by electronic bombardment. On reaching the cathode or by increasing the field emission from points on it the temp. is raised and the cathode hot spot is formed. F. J. L.

Absorption of solar radiation by the atmosphere in the *A* band. P. Lejay (Compt. rend., 1937, **205**, 585—588).—Absorption of solar radiation in the O_2 band at 7718—7593 A. has been investigated. The variation of the effective width of the band and its fine structure lines with the quantity of O_2 traversed is discussed, and the effective thickness of atm. O_2 at different periods of the year deduced. Absorption in this region is not due to H_2O vapour. A. J. E. W.

Degree of variability of calcium content in atmospheres of *A*-type stars. J. W. Abrams and E. Öpik (Astrophys. J., 1937, **86**, 203—211).—The abundance of Ca is relatively uniform in stars of the same spectrum and abs. magnitude. L. S. T.

Magnesium hydride in Arcturus and Antares. D. N. Davis (Astrophys. J., 1937, **86**, 109—118).—Previously unidentified lines between 4979 and 5211 A. in the spectrum of Arcturus are attributed to the 5211 band of MgH, whilst other lines are blends of MgH, TiO, C_2, and at. lines. The more conspicuous features of the MgH spectrum appear less intense in that of Antares. L. S. T.

Possible origin of the shift of spectral lines in nebulæ. L. Sibaiya (Current Sci., 1937, **6**, 152—153).—The shift observed in certain absorption lines is attributed to the presence of foreign gases in

the absorbing media. Cases are discussed in which H_2 or a rare gas at up to 400 atm. pressure, present with absorbing Ca II atoms, may cause the observed effects. A. J. E. W.

Ionising radiations of small quantum emitted spontaneously by ordinary metals. G. Reboul and J. Reboul (Compt. rend., 1937, **205**, 789—791).—The radiations emitted spontaneously by Sn, Pb, Fe, Zn, Al, Cu, and Ni have been shown to be due partly to the action of cosmic rays, and partly to a spontaneous natural emission of low penetration in the region of soft *X*-rays. R. S. B.

Thermionic emission. E. W. B. Gill (Phil. Mag., 1937, [vii], **24**, 1093—1103).—The thermionic emissions of both "bright" and coated filaments have been measured over the voltage range 4—900 v. The results are discussed, and compared with Schottky's theory. K. S.

Electron and ion current density distribution in wall-free gas discharges. A. Sibold (Helv. phys. Acta, 1936, **9**, 123—159; Chem. Zentr., 1936, i, 4264).—Langmuir probe investigations on the W arc in N_2 are recorded. J. S. A.

Ionisation and conductivity in gases at high pressures. J. Clay (Proc. K. Akad. Wetensch. Amsterdam, 1937, **40**, 824—836).—A general review of available data, and a discussion of factors affecting the determination of intensities of *X*-rays, γ-rays, β-rays, and cosmic rays by ionisation of He, air, Ne, A, Kr, and Xe at various pressures and field strengths. N. M. B.

Metallic reflexion and the surface photo-electric effect. R. E. B. Makinson (Proc. Roy. Soc., 1937, **A**, **162**, 367—390).—The effect of the electron density within the metal, calc. according to Sommerfeld's model, on an incident light wave is investigated. An expression for the photo-electric current is obtained and is compared with experimental results for K. The lack of agreement is discussed. G. D. P.

Electron mirrors. G. Hottenroth (Ann. Physik, 1937, [v], **30**, 689—712; cf. A., 1937, I, 99).—The properties as electron mirrors of potential fields of various types have been investigated experimentally. The influence of stray fields and of space charge is unimportant. Suitable arrangements for both converging and diverging mirrors are described. O. D. S.

Electron excitation and ion reflexion on bombardment of metals with K^+ ions. W. Veith (Ann. Physik, 1937, [v], **30**, 688; cf. A., 1937, I, 338).—A correction. O. D. S.

Positive ion emission from heated nickel wire in oxygen and hydrogen. R. Goto (Proc. Imp. Acad. Tokyo, 1937, **13**, 320—324).—Curves for the rate of decrease in current and pressure and for current–voltage with Ni wires with and without O_2 treatment after preliminary heating and evacuation in H_2 indicate that there is positive ion emission in both O_2 and H_2 and that it is enhanced on the oxidised surface. N. M. B.

Equilibrium between large and small ions in gas. O. Te-Tchao and A. Langevin (Compt. rend., 1937, **205**, 1049—1051).—If small positive and negative ions are formed in the presence of neutral particles, they are pptd. on to the particles to form large positive and negative ions, which then tend to recombine either with themselves or with smaller ions. The equilibrium conditions are investigated in terms of the ionic mobilities. If M is the no. of neutral particles, P of positive ions, and N of negative ions in equilibrium, P/M is approx. 0·07 and $N/P = 1·4$. J. A. D.

Passage of very rapid protons through matter. M. Drăgano (Compt. rend., 1937, **205**, 897—899).—Mathematical. A. J. E. W.

Positive rays of heavy metals, particularly of lead. A. Poirot and M. Auclair (Compt. rend., 1937, **205**, 908—909; cf. A., 1936, 130).—Positive rays of Pb have been obtained from $PbBr_2$ by the hot-anode method using high anode potentials. The bluish-violet light emitted in the path of the rays gives the Pb arc spectrum. Positive rays of all metals can probably be obtained by similar methods. A. J. E. W.

First report of the Committee on atoms of the International Union of Chemistry. F. W. Aston, N. Bohr, O. Hahn, W. D. Harkins, and G. Urbain (J.C.S., 1937, 1910—1912; cf. A., 1937, I, 592).—A table showing the isotopes of the elements with their relative abundance, embodying results reported during 1936, is given. A. J. M.

Sixth report of the Committee on at. wts. of the International Union of Chemistry. G. P. Baxter, O. Hönigschmid, and P. Lebeau (J.C.S., 1937, 1893—1900).—A report covering the period Sep. 30th, 1934, to Sep. 30th, 1935. The at. wts. of Ta and Ra have been changed to 180·88 and 226·05, respectively, and Pa is given the val. 231. Determinations of the at. wts. of K, Cr, As, Te, Tb, Eu, radio-Pb, Ra, Ba, and Pa are reviewed. A. J. M.

Seventh report of the Committee on at. wts. of the International Union of Chemistry. G. P. Baxter, O. Hönigschmid, and P. Lebeau (J.C.S., 1937, 1900—1909).—A report covering the period Sep. 30th, 1935, to Sep. 30th, 1936. Changes in the at. wts. of C, Rb, Gd, Pb, and U, to 12·01, 85·48, 156·9, 207·21, and 238·07, respectively, are made. Determinations of the at. wts. of O, H, C, K, Ga, Ge, Rb, Ag, Cd, Gd, Er, Ta, Pb, U, Mo, and W are reviewed. A. J. M.

Problems and methods of modern alchemy. A. Dorabialska (Rocz. Chem., 1937, **17**, 455—476).—A lecture. R. T.

Periodicity of the elements. L. Thayer-Ojeda (Separate, Valparaiso, 1937).—Speculative theory. F. R. G.

At. wt. of phosphorus. O. Hönigschmid and W. Menn (Z. anorg. Chem., 1937, **235**, 129—138).—$POCl_3$ was purified by treatment with P_2O_5 and fractional distillation, and the ratios $POCl_3 : 3Ag$ and $POCl_3 : 3AgCl$ were determined. The at. wt. of P is 30·978, in exact agreement with vals. obtained by the mass-spectrograph (A., 1936, 920) and from the density of PH_3 (A., 1930, 1104). F. J. G.

Recent discoveries in isotopy, with special reference to isotopes of hydrogen. E. Józefowicz (Rocz. Chem., 1937, **17**, 557—566).—A lecture. R. T.

New parabolic mass-spectrograph and determination of the relative abundance of the argon isotopes. W. Schütze (Wiss. Veröff. Siemens-Werken, 1937, **16**, 89—98).—The construction of a new mass-spectrograph based on the parabola method is described. The positive rays are produced in a metal discharge tube, pass into a charging chamber, and thence through a slit which can be finely adjusted outside the apparatus. They then pass between two magnetic poles in the form of plates, which are also the plates of a condenser. Finally they are recorded photographically. The apparatus was used to determine the relative abundance of the isotopes of A, with the result $^{40}A : {}^{38}A : {}^{36}A = 99{\cdot}64 : (0{\cdot}06 \pm 0{\cdot}005) : (0{\cdot}31 \pm 0{\cdot}02)$, in good agreement with other workers. The intensities of parabolas due to H_3^+, OH_3^+, and AH^+ are considered, and the existence of H_3^+ is discussed. A. J. M.

Extreme intervals between radioactive emissions. II. E. J. Gumbel (J. Phys. Radium, 1937, [vii], **8**, 446—452; cf. A., 1933, 659).—Comparisons of the observations on the extreme intervals between radioactive emissions obtained by different methods in general agree well with theory, but certain discrepancies make it desirable to reconsider the calculations in the light of precise observations in order that the mean interval between emissions may be known more accurately. W. R. A.

Shape of the continuous β-spectrum of thorium-*C.C'*. H. O. W. Richardson and A. Leigh-Smith (Proc. Roy. Soc., 1937, **A**, **162**, 391—403).—By use of a radioactive vapour of Th-*B* + *C* in a cloud chamber about 200 Th-*C.C'* disintegrations were photographed, and the energies of the nuclear electrons estimated. A large proportion of electrons having energies as low as 15 kv. are observed and it is concluded that the energy distribution curve does not pass through the origin. The curve agrees with the predictions of the (0, 1) interaction formula of Konopinski and Uhlenbeck (cf. A., 1935, 1048). G. D. P.

Analysis of the β-rays of rubidium by means of absorption with coincident counters. Z. Ollano (Nuovo Cim., 1937, **14**, 314—321).—By means of the arrangement of two counters described, which is suitable for the absorption analysis of low-energy particles, two groups of particles have been observed in the β-radiation from Rb, viz., a group with an absorption coeff. in Al of 422 cm.$^{-1}$ and another softer, non-homogeneous group with a mean absorption coeff. in Al of 1050 cm.$^{-1}$ No harder β-radiation could be found. With a modified single-counter arrangement the emission of weak *X*-rays from the disintegration product of Rb (^{87}Sr) has been observed. O. J. W.

β- and γ-Rays from radioactive bodies. J. Surugue (Ann. Physique, 1937, [xi], **8**, 484—554).—Using the method of deviation and focussing, in a uniform magnetic field produced by a large permanent magnet, of β-rays formed by internal conversions, an investigation was made of the Ac group and of active Th deposit, in order to determine the energy of the secondary β-rays and hence the energy of the primary γ-rays produced in the course of successive transformations. From these are constructed nuclear energy level schemes in each case. Full data and results are tabulated. N. M. B.

Absorption of hard γ-rays by the photonuclear effect in beryllium. J. Rotblat (J. Phys. Radium, 1937, [vii], **8**, 477—480).—The activity excited in Ag by neutrons formed in the photodissociation of Be by the hard γ-rays of Ra-*C* is obtained as a function of the absorption of neutrons by different thicknesses of Pb, Cu, and Al. Exponential absorption curves are obtained indicating that the photonuclear effect in Be results from only the hardest γ-rays of Ra-*C*. λλ of the active γ-rays and their energy are given. Reasons are given for the contradictory results of Gentner (A., 1934, 938). W. R. A.

Influence of temperature on the capture of neutrons by various elements. J. L. Michiels and J. A. Saxton (Proc. Roy. Soc., 1937, **A**, **162**, 441—449).—The radioactivity induced by neutrons which have passed through a layer of wax at 90° K. is 30—60% > that induced in the same material by neutrons which have passed through wax at 290° K. The materials examined are In, Au, Na, As, Mn, Br, Al, and Ag. The fraction of the activity due to group *C* neutrons is determined. It is concluded either that Cd absorbs neutrons other than those of thermal energy or that all elements do not conform to the same absorption law. The activity produced in In by group *D* neutrons is not affected by the temp. of the wax. G. D. P.

Neutrons from the disintegration of nitrogen by deuterons. W. E. Stephens, K. Djanab, and T. W. Bonner (Physical Rev., 1937, [ii], **52**, 1079—1082).—The energy distribution of the neutrons from the disintegration of N by 0·93 m.e.v. deuterons was investigated by measuring the ranges of recoil protons in a high-pressure cloud chamber. Three groups of recoil protons had max. energies 5·7, 2·7, and 1·9 m.e.v., with relative intensities 2 : 1 : 3. The 2·7 group is attributed to D_2 contamination on the target. The other two groups are from the reaction $^{14}_{7}N + {}^{2}_{1}H = {}^{15}_{8}O + {}^{1}_{0}n + Q_1$, where $Q_{10} = 5{\cdot}1 \pm 0{\cdot}2$ and $Q_{11} = 1{\cdot}1 \pm 0{\cdot}2$ m.e.v. N. M. B.

Neutron resonance levels of iridium and rhodium and the mutual overlapping of their resonance regions. R. Jaeckel (Z. Physik, 1937, **107**, 669—679).—Measurements of neutron absorption with Ir as indicator and Rh as absorber give the relative positions of Ir and Rh levels. Absorption by both Ir and Rh in the region of thermic neutrons is due mainly to a single resonance level. H. C. G.

Angle relationships for the scattering of neutrons by protons. E. Philipp (Z. Physik, 1937, **107**, 683—708).—A mathematical analysis of the mutual interaction of neutrons and protons in the light of recent experimental work. H. C. G.

Artificial radioactivity of antimony induced by slow neutrons. K. Alexeeva (Compt. rend. Acad.

Sci. U.R.S.S., 1937, **17**, 13—14; cf. A., 1934, 1284; 1935, 910; 1936, 1315).—Irradiation of Sb for 42 days with slow neutrons (from γ-rays on Be retarded by paraffin) yields a product of half-life period 45 days which emits both β- and γ-rays, half the former being absorbed by 0·3 mm. of Al. This activity is attributed to the formation of $^{123}_{51}$Sb and $^{124}_{51}$Sb. J. W. S.

Nuclear reaction Be (α, n) and mass of neutron by a new method. J. Crussard and S. Gorodetzki (Compt. rend., 1937, **205**, 1060—1062).—Be is bombarded with α-particles from Po; resulting neutrons are detected by the disintegration of a B coating covering the interior walls of an ionisation chamber. The neutrons are retarded by paraffin wax. The suggested reaction is: $^{9}_{4}\mathrm{Be} + ^{4}_{2}\mathrm{He} \rightarrow 3^{4}_{2}\mathrm{He} + ^{1}_{0}n + Q$. If the masses of the particles are considered to be known, Q can be compared with experiment; conversely if Q is measured experimentally the mass of the neutron can be calc. The val. $^{1}_{0}n = 1{\cdot}0090$ so obtained agrees well with other determinations. J. A. D.

Energies of electrons and positons emitted in certain nuclear reactions. C. Magnan (Compt. rend., 1937, **205**, 1147—1149).—The max. energy limits of the positons emitted during α-particle bombardment of F, Na, K, and Al have been determined, using a spectrograph with magnetic focussing. Bombardment of Cl_2 with α-particles gives a spectrum showing three sharp peaks, attributed to γ-rays; the corresponding energies are approx. equal to the differences of energy between the three groups of protons emitted in the reaction $^{35}_{17}\mathrm{Cl} + ^{4}_{2}\mathrm{He} \rightarrow ^{38}_{18}\mathrm{A} + ^{1}_{1}\mathrm{H}$. A. J. E. W.

Nature of cosmic-ray particles. Y. Nishina, M. Takeuchi, and T. Ichimiya (Physical Rev., 1937, [ii], **52**, 1198—1199).—Investigations on the penetration of Pb in a cloud-chamber indicate that 80—90% of the cosmic rays consist of heavy particles containing some of both signs and of higher penetration than protons of the same momentum. Results support the existence of a new particle of mass $\frac{1}{7}$—$\frac{1}{10}$ that of the proton and initial momentum $7{\cdot}4 \times 10^5$ gauss-cm. (cf. Neddermeyer, A., 1937, I, 390). N. M. B.

Origin of cosmic radiation. H. Alfven (Z. Physik, 1937, **107**, 579—588).—An extension of earlier work (cf. A., 1937, I, 6, 340) in which it is shown that by assuming a weak magnetic field in interstellar space the more important properties of cosmic radiation may be explained by means of classical electrodynamics. L. G. G.

Production of hard cosmic-ray showers. K. Schmeiser and W. Bothe (Naturwiss., 1937, **25**, 833).—The effect of the intensity of hard cosmic-ray showers on the metal (Pb or Fe) used was investigated. The max. of the Rossi curve corresponding with soft showers is lower for Pb than for Fe, but the max. due to hard showers is approx. the same for both. The intensity of hard showers is, therefore, more nearly $\propto$ at. no. than to (at. no.)^2. The hard showers are produced by the hard component of the primary rays. Hard showers may themselves give rise to soft ones, and occur in the free atm. A. J. M.

Production of cosmic-ray showers at great depths. W. H. Pickering (Physical Rev., 1937, [ii], **52**, 1131—1134).—Experiments proving the existence of cosmic-ray showers, consisting of at least three particles, at depths down to 30 m. of H_2O below sea level are described. The no. of showers and of vertical coincidences decrease with depth in a similar manner. The effect of Pb on the showers at great depths is discussed. N. M. B.

Focalisation of bundles of charged particles by circular deviation in a transverse magnetic field. L. Cartan (J. Phys. Radium, 1937, [vii], **8**, 453—470).—The theory and application of various methods are considered. W. R. A.

Molecular viewpoints in nuclear structure. J. A. Wheeler (Physical Rev., 1937, [ii], **52**, 1083—1106).—Mathematical. A wave-functional study of the three-body nucleus leading to a concept of resonating group structure whereby various calculations on nuclear motion are made. N. M. B.

Mathematical description of light nuclei by the method of resonating group structure. J. A. Wheeler (Physical Rev., 1937, [ii], **52**, 1107—1122; cf. preceding abstract).—Mathematical. N. M. B.

Theory of the neutrino. II. J. Solomon (J. Phys. Radium, 1937, [vii], **8**, 433—438).—Mathematical. An extension of previous work (A., 1937, I, 390) by introducing a special operator gives the general form of the β-ray spectrum of radioactive disintegration as well as the interaction of protons and neutrons. It is possible to determine the operator so that good agreement between the theory and experimental data is obtained. W. R. A.

Symmetry between particles and anti-particles. G. Racah (Nuovo Cim., 1937, **14**, 322—328).—Mathematical. O. J. W.

Wave-mechanical investigation of repulsion between neutral inert gas atoms. B. O. Grönblom (Soc. Sci. fenn. Comment. phys.-math., 1936, **8**, No. 13, 9 pp.; Chem. Zentr., 1936, i, 4113).—Theoretical. J. S. A.

Quantum exchange and nuclear isomerism; determination of nuclear isomerism. T. Kahan (Compt. rend., 1937, **205**, 899—900).—Nuclear isomerism in the atoms of a diat. mol. can be detected by the absence of alternations of intensity in the band spectrum. Absence of diffusion with quantum exchange during internuclear collision processes is also an indication of isomerism. A. J. E. W.

Orthogonal systems of electronic optics and their application to spectroscopy. M. Cotte (Compt. rend., 1937, **205**, 974—976).—Theoretical. E. S. H.

Probability of collisions of the second kind between atoms and free electrons. V. Fabrikant (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 249—259).—Mathematical. A quant. application of the Klein–Rosseland relation is developed. N. M. B.

Use of charge-conjugated wave functions in the hole theory of the electron. H. A. Kramers

(Proc. K. Akad. Wetensch. Amsterdam, 1937, **40**, 814—823).—Mathematical. N. M. B.

Wave functions for large arguments by the amplitude-phase method. J. A. WHEELER (Physical Rev., 1937, [ii], **52**, 1123—1127).—Mathematical. Simplified methods are considered. Vals. of the amplitude and phase of the Coulomb functions needed in the treatment of the scattering of α-particles in He are tabulated. N. M. B.

Rôle of argon in the production of Swan bands. N. R. TAWDE and D. D. DESAI (Proc. Indian Acad. Sci., 1937, **6**, **A**, 266—280).—The intensity changes which take place in a discharge tube with C and Al electrodes near the C electrode, in the presence of A (p = 10, 15, 20, 25, 30 mm. Hg), show no marked regularity. The most probable transition in the C_2 (Swan) system of bands is indicated and a mechanism for their production is put forward. F. J. L.

Ultra-violet absorption spectrum of atmospheric ozone. G. DÉJARDIN and A. ARNULF (Compt. rend., 1937, **205**, 1000—1002).—The absorption spectrum has been determined between 3660 and 3134 A. The results are compared with published data for O_3. E. S. H.

Possible interpretation of ozone bands. L. HERMAN and H. MONTAGNE (Compt. rend., 1937, **205**, 1056—1057).—The energy levels of the mol. O_3 are represented by terms which explain the observed bands in the O_3 spectrum. J. A. D.

Atmospheric absorption and ozone absorption. G. DÉJARDIN, A. ARNULF, and R. FALGON (Compt. rend., 1937, **205**, 1086—1088).—The effective thickness of the atm. O_3 content has been calc., taking into account the increase of absorption at lower temp. J. A. D.

Properties of ozone and their geophysical consequences. E. VASSY (Ann. Physique, 1937, [xi], **8**, 679—777; cf. A., 1936, 774, 1208).—Variations with temp. of the intensity of the band systems of O_3 were investigated by comparison of the coeffs. of max. and min. absorption at different temp. with a view of finding a relation by which the $[O_3]$ may be determined spectrographically. These results are applied to the estimation of the variation of $[O_3]$ in the atm. with altitude. The wide variation with temp. of the rate of decomp., studied in the range 95—156°, shows, in conjunction with atm. temp. at high altitudes, that the former controls the existence of O_3 in the atm., and indicates that it is not present at altitudes >60 km., and that the auroral electrons are not responsible for its formation. N. M. B.

Temperature determinations from band spectral data. H. P. KNAUSS and M. S. MCCAY (Physical Rev., 1937, [ii], **52**, 1143—1150).—A method of interpreting intensity distributions of lines in a band for determining the temp. of the emitter is developed. The method is independent of photometer calibration, the criterion being the place in the band where adjacent lines of overlapping branches are of equal intensity. Application to the Ångström bands of CO is discussed. N. M. B.

Absorption coefficient of nitrogen pentoxide in the ultra-violet and the visible absorption spectrum of nitrogen hexoxide. E. J. JONES and O. R. WULF (J. Chem. Physics, 1937, **5**, 873—877).—Absorption spectra of the gaseous system, $N_2O_5 + O_3$, during the decomp. of O_3 and the subsequent decomp. of N_2O_5 are discussed. The absorption coeff. of N_2O_5 increases in val. in the direction of shorter λ, no max. being observed as far as 2400 A. Spectra of NO_3 in the visible at various stages of the reaction are recorded. W. R. A.

(A) Spectrum of SnF. (B) Spectrum of AgCl. F. A. JENKINS and G. D. ROCHESTER (Physical Rev., 1937, [ii], **52**, 1135—1140, 1141—1143).—(A) Using a C tube furnace, measurements of the SnF absorption bands and resolution of the Sn isotope effect are reported for the first time. Analysis of the frequencies of the band heads shows four doublet systems, λλ 2660—3260, 2556—2635, 2100—2350, and 2060—2300, all due to transitions from a doublet normal state, of separation 2317·3 cm.$^{-1}$, and two continuous bands.

(B) Absorption of AgCl vapour investigated with high dispersion below λ 2500 shows a new band system, an equation for which is found, and a fragment of another similar system. Strong continuous absorption is observed at higher pressures. N. M. B.

Band spectrum of TiCl. K. R. MORE and (MISS) A. H. PARKER (Physical Rev., 1937, [ii], **52**, 1150—1152).—The emission spectrum of TiCl, excited by high- and low-frequency discharges through a continuous flow of $TiCl_4$ vapour in a discharge tube, consists of one strong group of bands at 4200—4100 A., attributed to a transition between doublet electronic levels, and several weaker groups at 4100—3700 A., all degraded to shorter λλ. Data and analyses are given. N. M. B.

Absorption spectra and photodissociation of halides and oxyhalides of sulphur, selenium, and tellurium. S. L. HUSSAIN and R. SAMUEL (Proc. Physical Soc., 1937, **49**, 679—692; cf. A., 1936, 775).—An investigation of the absorption spectra of $SOBr_2$, $S_2O_5Cl_2$, $SeCl_4$, $SeOCl_2$, Se_2Cl_2, $SeBr_4$, Se_2Br_2, $TeCl_2$, $TeCl_4$, $TeBr_2$, and $TeBr_4$ in the vapour state is reported; photodissociation processes and linking energies are determined and detailed conclusions are discussed. N. M. B.

Emission spectrum of silicon tetrabromide. R. K. ASUNDI and S. M. KARIM (Proc. Indian Acad. Sci., 1937, **6**, **A**, 281—286).—The emission spectrum of $SiBr_4$ under different conditions of flowing vapour, using condensed and uncondensed discharge, has been measured. With p >0·5 mm. Hg, continuous bands $\lambda\lambda_{max.}$ 4220, 3570, 3435, 3345, 3120, 2910, 2780—2710, 2640—2630, 2420, 2370 A. are observed; with p at 0·2 mm. all disappear except the first. At p = 0·05 mm. a narrow set of bands between λλ 3700 and 3930 A. appear, probably due to triat. $SiBr_2$, and between λλ 3350 and 2700 a large no. of bands, some degraded towards the long and some towards the short λ, probably due to SiBr mols. or $SiBr^+$. F. J. L.

Absorption of copper sulphate and the effect of heavy water of crystallisation. B. DUHM (Z. Physik, 1937, **107**, 589—594).—The absorption spectra of $CuSO_4,5H_2O$ and $CuSO_4,5D_2O$ crystals were measured over the range 190—1800 mμ. Replacement of H by D results in a narrowing and lowering in intensity of the Cu^{++} band at 790 mμ. L. G. G.

Light absorption of potassium permanganate. A. L. S. RAO (Current Sci., 1937, **6**, 154—155; cf. A., 1932, 557).—The spectrum in the λ range 2000—9000 A. consists of three distinct regions, red to 4250 A. (containing seven bands), 3900—2750 A. (containing two bands, one showing discrete structure), and 2600—2000 A. (also containing two bands, the one of lower λ becoming a region of continuous absorption at high conens.). A. J. E. W.

Photodecomposition and absorption spectrum of potassium permanganate. A. L. S. RAO (Proc. Indian Acad. Sci., 1937, **6**, **A**, 293—300).—See preceding abstract. Photodecomp. is investigated using monochromatic light; there is no strongly selective λ, but the regions λλ 2900—3200 and 2250—2000 A. are most active. F. J. L.

Absorption of ultra-violet light by some organic substances. XLIII. W. BEDNARCZYK and L. MARCHLEWSKI. **XLIV.** R. GRINBAUM and L. MARCHLEWSKI. **XLV. Derivatives of phenanthrene and indole.** R. GRINBAUM and L. MARCHLEWSKI. **XLVI.** W. BEDNARCZYK and L. MARCHLEWSKI (Bull. Acad. Polonaise, 1937, **A**, 140—155, 156—170, 171—186, 187—200; cf. A., 1937, I, 343).—XLIII. The existence of continuous or banded absorption spectra is applied to determine the presence of the aldo- and keto-groups, respectively, in various sugars. Fructose, in aq. and MeOH solutions, shows a banded absorption (max. 2800 A.); melibiose, maltose, cellobiose, and trehalose in aq. solution all show continuous absorption which changes to a band absorption in the presence of alkali (p_H 11—13). The derivatives of glucose with ring structures all show continuous absorption.

XLIV. The absorption spectra (2200—4000 A.) for aq. solutions of aspartic, glutamic, and kynurenic acids, cystine, creatine, creatinine, uracyl, and EtOH solutions of piperonylic acid, piperonal, and the nitroanilines are examined and the extinction coeffs. given. The effects of free $H^{\cdot}$ and OH' ions are described.

XLV. The spectrum of phenanthrene, in EtOH solution, shows maxima at 2515 and 2937 A. The tetrahydrophenanthrenes (in EtOH) show maxima at 2287 and 2525 A., 2285 and 2565 A. for compounds with b.p. 310° and 302°, respectively. The 2-, 3-, 4-, and 9-NO_2-derivatives show, in addition to a max. at about 2500 A., a broad band between 3100 and 3800 A. Octachlorophenanthrene shows a spectrum similar to those of the NO_2-compounds, whereas that of dibromophenanthrene is very similar to that of the hydrocarbon. All the indole derivatives show similar spectra with absorption maxima in the regions 2800 and 2200 A.

XLVI. The spectra of 8-hydroxyquinoline, $COPh_2$ and its oxime, allyl alcohol, linalool, and geraniol in EtOH solution; farnesol, *o*-*p*-toluoylbenzoic acid and its oxime in EtOH solution; diketopiperazine in aq. solution, and phytol in EtOH–Et_2O solution are described. K. S.

Absorption of ultra-violet light by fluorocyclene and products of its transmutations. W. BEDNARCZYK and L. GIZLER (Bull. Acad. Polonaise, 1937, **A**, 455—461).—The ultra-violet absorption spectra of fluorocyclene and its H_4-, H_8-, and H_{12}-derivatives, diacenaphthylidene, and decacyclene have been measured. All show selective absorption and obey Beer's law, the spectrum of the parent hydrocarbon being less continuous than those of the hydrogenation products. F. J. L.

Light absorption of organic compounds. VIII. Azo-compounds. A. BURAWOY (J.C.S., 1937, 1865—1869).—The absorption spectra of a no. of azo-compounds have been investigated, the absorption max. and mol. extinction coeffs. (usually in C_6H_{14} solution) being determined. The results confirm the classification into *K*- and *R*-bands previously suggested (A., 1933, 62, 208, 590). A. J. M.

Absorption spectra of organic substances in concentrated sulphuric acid. I. Carbohydrates F. BANDOW (Biochem. Z., **294**, 124—137).—The absorption spectra in 96% H_2SO_4 of glucose, arabinose, rhamnose, mannose, sorbitol, gluconic acid, saccharic acid, lævulic acid, mannitol, glycuronic acid, ascorbic acid, glyceraldehyde, furfuraldehyde, digitonin, salicin, and pancreatin have been measured; also that of mannose in conc. H_3PO_4 and furfuraldehyde in different acid–alcohol–H_2O solutions. In conc. H_2SO_4 most substances show a marked absorption band between 2500 and 3500 A.; on dilution a strong band at 2900 A. appears. Glycuronic acid has the same spectrum as glucose. Mannitol, sorbitol, gluconic, saccharic, and lævulic acids give irregular and weaker absorption bands. C. C. N. V.

Light absorption of porphin dyes; relation to structure. A. HAGENBACH, F. AUERBACHER, and E. WIEDEMANN (Helv. phys. Acta, 1936, **9**, 3—26; Chem. Zentr., 1936, i, 4304—4305).—Absorption spectra for λ = 240—700 mμ. in Et_2O containing a little C_5H_5N are recorded; the results are correlated with structure. It is concluded that in hæmin the Fe is equally bound to the four N atoms. H. N. R.

Absorption spectrum of vitamin-*C*. B. SKARZYNSKI (Bull. Acad. Polonaise, 1937, **A**, 462—476).—The absorption spectrum of vitamin-*C* has been measured at various p_H (2·4—6·1) in aq. and EtOH solutions. In aq. solutions the absorption band is λλ 2640—2660 A., and the extinction coeff. is 48,000—55,000; at p_H 2·4 $\lambda_{max.}$ is 2400—2450 A., extinction coeff. 40,000. In 96% EtOH $\lambda_{max.}$ is 2450 A. in conc. solution, and 2650 A. in dil. solution, extinction coeff. 40,000—46,000. The band at 2650 A. is due to the dissociated mol. and that at 2450 A. to the undissociated mol. The buffer solutions used are Na_2HPO_4 + citric acid and HCl + Na citrate. F. J. L.

[Infra-red] absorption spectrum of water in the liquid state. A. CARRELLI (Nuovo Cim., 1937, **14**, 245—256).—Measurements of the infra-red ab-

sorption spectra of saturated solutions of KCl, NaCl, and $CaCl_2$ and of solid $CaSO_4,2H_2O$ give results which support the classification of the absorption bands of H_2O by other workers. The absorption of $CaSO_4,2H_2O$ is different along different crystallographic axes. Anhyd. $BaSO_4$ gives two bands at 4·7 and 3·5 μ. The interpretation of the 4·7 μ. band is discussed. O. J. W.

Structure of water, studied in the infra-red. J. ERRERA (J. Chim. phys., 1937, **34**, 617—626; cf. A., 1937, I, 495).—The absorption spectrum of water near 3 μ., with varying physical state, temp., solvent, and concn., is further described and compared with similar data for alcohols (A., 1937, I, 9, 167). The free mol. vibrations occur in the vapour, and in low concn. in inert solvents (CCl_4, CS_2). In solvents containing O (dioxan) by transitory H bond solute–solvent interaction the O·H band of H_2O at 3640 cm.$^{-1}$ is split and displaced to higher λ (3515, 3575 cm.$^{-1}$). With increasing concn., or in liquid water and ice, the H linking of H_2O mols. gives bands at ~3250, 3400 cm.$^{-1}$; these are ascribed to lattice and non-lattice modes respectively, the latter being involved in the dielectric const. anomalies of ice. I. McA.

Absorption bands (CH) of saturated and ethylenic hydrocarbons between 6000 and 9500 A. P. BARCHEWITZ (Compt. rend., 1937, **205**, 976—978).—The third, fourth, and fifth harmonics of the fundamental band characteristic of (CH) have been studied. The saturated can be distinguished from the ethylenic hydrocarbons, and in the latter it is possible to estimate approx. the length of the C chain and the extent of branching from the intensity of the CH_2 and CH_3 bands. E. S. H.

Plane fundamental modes of vibration of deuteroethylenes. C. MANNEBACK (J. Chem. Physics, 1937, **5**, 989).—The reasons by which it was possible for Wu (A., 1937, I, 397) to assign the plane vibration frequencies of the three isomeric $C_2H_2D_2$ mols. are discussed and it is pointed out that quant. results had previously been obtained by different authors. W. R. A.

Infra-red association band of a heavy alcohol. G. BOSSCHIETER (J. Chem. Physics, 1937, **5**, 992).—Comparison of the infra-red spectra of a substance in the liquid and vapour states yields information regarding association of the substance. In $CH_2D·OD$ the CH_2D band remains unaltered in both states but the O–D band, unimol. in the vapour state at 2721 cm.$^{-1}$, appears as a broad association band at 2500 cm.$^{-1}$ in the liquid state; this agrees with recorded data on other alcohols. Analogous effects are found by examining the spectra of gaseous, liquid, and solid H_2O and solutions of H_2O in CCl_4, CS_2, or dioxan. W. R. A.

Infra-red spectra. Absorption of some hydroxy-compounds in the region of 3 μ. J. J. FOX and A. E. MARTIN (Proc. Roy. Soc., 1937, **A**, **162**, 419—441).—Absorption measurements have been carried out in the range λ = 2·5 to 3·9 μ. The substances investigated are PhOH, $CH_2Ph·OH$, $CHPh_2·OH$, $Bu^{\alpha}OH$, $Bu^{\gamma}OH$, stearyl alcohol, and $C_{16}H_{33}·OH$, in solution in CCl_4, CCl_4 + 17% C_2Cl_6, C_2Cl_4, and $CHCl_3$. The changes in intensity and position of both OH and CH absorption bands are discussed. G. D. P.

Spectroscopic studies of the hydrogen bond. II. Shift of the O–H vibrational frequency in the formation of the hydrogen bond. R. M. BADGER and S. H. BAUER (J. Chem. Physics, 1937, **5**, 839—851; cf. A., 1937, I, 495).—The association spectra of a no. of acids and alcohols, observed both in solution and in the pure liquids, between 9000 and 11,000 A. show a broad band with max. near 10,000 A. whilst the alcohols show an additional weaker band near 9000 A. From its behaviour with change of concn. and temp. the 10,000 A. band is identified with the O·H group. New evidence is given that a weak intermol. linking is formed between $COMe_2$ and MeOH. O–H absorption for intermol. H bonds is discussed. A relation between the energy of the H bond and the shift of the O–H vibrational frequency is indicated and its use in the interpretation of certain spectra suggested. W. R. A.

O–H band in the vapours of some organic acids and of tertiary amyl alcohol in the region of 9700 A. S. H. BAUER and R. M. BADGER (J. Chem. Physics, 1937, **5**, 852—855).—Absorption bands corresponding with the third harmonic of the O–H vibration have been observed in the vapours of HCO_2H, AcOH, $EtCO_2H$, and $CCl_3·CO_2H$. Only HCO_2H gave a band with resolvable fine structure; rotational consts. and the moments of inertia for the HCO_2H mol. have been evaluated. The structures of the org. acid mols. are discussed and compared with HNO_3. In *tert.*-amyl alcohol a broad max. at about 10,414 cm.$^{-1}$ was found. W. R. A.

Characteristic frequencies of chlorates, bromates, and iodates. M. PARODI (Compt. rend., 1937, **205**, 607—609).—λλ of absorption bands of MXO_3 (M = Na, K; X = Cl, Br, I) in the range 20—40 μ. are recorded. The deduced characteristic frequencies of XO_3 agree with the observed Raman frequencies (A., 1937, I, 218) and confirm the hypothesis of a pyramidal structure for the ions. A. J. E. W.

Transmission of oxides in the far infra-red. M. PARODI (Compt. rend., 1937, **205**, 906—908; cf. A., 1937, I, 393).—λλ of absorption bands in the range 20—60 μ. for CoO, CuO, CdO, TiO_2, MnO_2, MoO_2, PbO_2, Mn_2O_3, Ni_2O_3, Al_2O_3, and Sb_2O_3 are recorded and discussed. A. J. E. W.

Raman spectra and the structure of molecules. T. URBAŃSKI (Rocz. Chem., 1937, **17**, 477—496).—A lecture. R. T.

Attempt at classification of the Raman lines of a quartz crystal. J. CABANNES and C. BOUHET (Compt. rend., 1937, **205**, 768—771; cf. A., 1937, I, 394).—The polarisation of the Raman lines of a mol. with a ternary axis is discussed and applied to a quartz crystal, for which the following frequencies have been obtained: 466, 207 and 356 (completely symmetrical), 266 and 798 (degenerate of the first kind), 128, 394, 1163, and 696 (degenerate of the

second kind), 1163—1227, 1064, 798, and 501 cm.$^{-1}$ (probably the fundamental frequencies of SiO_4). R. S. B.

Low and high frequencies for water. J. H. HIBBEN (J. Chem. Physics, 1937, **5**, 994).—Redetermination of the Raman spectrum of H_2O using a low-pressure Hg arc with filters capable of absorbing all radiation <2537 A. reaffirms previous results (A., 1937, I, 218) which had been attributed by Rao and Koteswaram (*ibid.*, 496) to Hg lines. The frequencies at 4023 and 5100 cm.$^{-1}$ are discussed and the explanation of Rao and Koteswaram is shown to be erroneous. W. R. A.

Infra-red studies. III. Absorption bands of hydrogels between 2·5 and 3·5 μ. A. M. BUSWELL, K. KREBS, and W. H. RODEBUSH (J. Amer. Chem. Soc., 1937, **59**, 2603—2605; cf. A., 1937, I, 443).—Films of β-amylose, agar, or glucose show absorption at 3 μ. (O:H:O), which appears ∝ their H_2O content, but show no absorption at 2·75 μ. (OH). Gelatin shows absorption at 3, 3·2, and 3·4 μ., but not at 2·75 μ. Montmorillonite shows absorption at 3 and 2·75 μ.; the height of the 3 μ. band is more strongly affected by H_2O content than is that of the 2·75 μ. band. E. S. H.

Raman spectrum of solid hydrogen sulphide. S. C. SIRKAR and J. GUPTA (J. Chem. Physics, 1937, **5**, 990).—Polemical against Murphy and Vance (A., 1937, I, 496). W. R. A.

New line in the Raman spectrum of solid carbon dioxide. S. C. SIRKAR and J. GUPTA (Current Sci., 1937, **6**, 214).—A new line with $\Delta\nu$ = 58 cm.$^{-1}$ has been observed. It is twice as strong as the intense line 1388 cm.$^{-1}$, and may be due to intermol. oscillations in loosely polymerised groups formed at the low temp. L. S. T.

Raman spectrum of D_3AsO_4 and its salts. F. FEHER and G. MORGENSTERN (Naturwiss., 1937, **25**, 831).—The Raman frequencies of D_3AsO_4 (86·5%), NaD_2AsO_4, and Na_2DAsO_4 are given and compared with those of H_3AsO_4, NaH_2AsO_4, and Na_2HAsO_4, respectively. The spectra of the corresponding compounds are the same with the exception of a slight displacement of one line in each spectrum. A. J. M.

Raman spectra of $CMeF_3$ and $CCl_2{:}CF_2$. J. B. HATCHER and D. M. YOST (J. Chem. Physics, 1937, **5**, 992—993).—Raman frequencies for the liquid state are given and discussed. $CMeF_3$ in the gaseous state absorbs in the ultra-violet with consequent decomp. of the gas. W. R. A.

Raman spectra of the methyl alcohols, $CH_3{\cdot}OH$, $CH_3{\cdot}OD$, and $CH_2D{\cdot}OD$. J. O. HALFORD, L. C. ANDERSON, and G. H. KISSIN (J. Chem. Physics, 1937, **5**, 927—932; cf. A., 1936, 1180).—$CH_3{\cdot}OD$ was prepared by treating dry $Mg(OMe)_2$ with 99·8% D_2O; $CH_2D{\cdot}OD$ was made from D_2O and CH_2N_2 in the presence of a small amount of D_2SO_4. Data for the frequencies of the Raman displacements and microphotometric curves are given and used to assign provisionally the fundamental frequencies. The significance of the character of the OH and OD bands to the problem of internal rotation is discussed. A new approximation to a potential const. for the C·O linking is given. W. R. A.

Raman effect and some cases of allyl–propenyl isomerism. R. DELABY, L. PIAUX, and A. GUILLEMONAT (Compt. rend., 1937, **205**, 609—611; cf. A., 1935, 197; 1936, 702).—The Raman spectra of the Br, S, and CN derivatives of $OH{\cdot}CHBu{\cdot}CH{:}CH_2$, and of the S derivative of $OH{\cdot}CHEt{\cdot}CH{:}CH_2$, have been investigated; the products consist predominantly of *trans*-$R{\cdot}CH{:}CH{\cdot}CH_2X$, with a small quantity of $R{\cdot}CHX{\cdot}CH{:}CH_2$. Frequencies of the constituent groupings are deduced. Br and S atoms in the α-position have approx. equiv. effects on the C:C linking frequency. No conjugation occurs between the C:C and C:N linkings. A. J. E. W.

Raman spectrum of deuterated benzenes and the symmetry of the benzene molecule. A. KLIT and A. LANGSETH (J. Chem. Physics, 1937, **5**, 925—926).—The totally-symmetrical frequency (ν_1) of about 992 cm.$^{-1}$ can appear in the spectrum of all deuterated benzenes but the trigonally-symmetrical frequency (ν_{12}) of about 1010 cm.$^{-1}$ is forbidden by selection rules from appearing in the spectrum of C_6H_6, C_6D_6, *p*-$C_6H_4D_2$, and *p*-$C_6H_2D_4$. Experimental vals. of these frequencies are recorded for C_6H_6 and all the deuterobenzenes. On the assumption that the substitution of a D atom will bring about a corresponding diminution in the frequency, vals. for these two frequencies are computed for the different compounds. This leads to the prediction that the frequency will have identical vals. for isomeric benzenes; this is not substantiated by experiment, except for *o*-$C_6H_4D_2$ and *o*-$C_6H_2D_4$. Consideration of the symmetry of the various compounds shows that ν_{12} is antisymmetrical to the twofold axis in *o*-$C_6H_2D_4$ but is symmetrical to the twofold axis in all other compounds of the same symmetry. In certain compounds ν_1 is < the calc. val. and ν_{12} is higher by about the same amount, and this increased separation between the two frequencies is accompanied by an enhanced intensity of the ν_{12} frequency. This behaviour is attributed, on the assumption of D_{6h} (plane hexagonal) symmetry for C_6H_6, to resonance between ν_1 and ν_{12}, and can occur for all the symmetries exhibited by the partly-deuterated benzenes except the symmetry of *o*-$C_6H_2D_4$. The evidence strongly favours the D_{6h} structure of C_6H_6. W. R. A.

Raman spectra of acrylic acid and of unpolymerised and polymerised methyl methacrylate. D. MONNIER, B. SUSZ, and E. BRINER (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 104—106).—νν and intensities are recorded. The C:O frequency is increased on passing from the acid to the ester. The C:C and $>C{:}CH_2$ frequencies are not observed in the polymerised ester, but a CH_3 frequency is strongly intensified; polymerisation is thus probably due to breaking of C:C linkings and chain formation. A. J. E. W.

Raman effect. LXXVI. Hydrazine and derivatives. LXXVII. Association of benzene derivatives containing the CO group, especially benzoyl chlorides. L. KAHOVEC and K. W. F. KOHLRAUSCH (Z. physikal. Chem., 1937, **B**, **38**, 96—118, 119—139).—LXXVI. The Raman spectrum

shows that N_2H_4 does not consist solely of the *trans*-form $NH_2{\cdot}NH_2$, or of $NH_3{:}NH$. The presence of an equilibrium mixture of the two is not excluded, but on other grounds is regarded as unlikely. The Raman spectrum of the hydrate resembles that of N_2H_4 so closely that it is inferred that it is actually a hydrate, N_2H_4,H_2O, the O and N probably being linked by a single-electron linking of the H_2O. On the other hand, the formulation of the hydrochlorides as $NH_2{\cdot}NH_3{\cdot}Cl$ and $NH_3Cl{\cdot}NH_3Cl$ is confirmed. Evidence of association of N_2H_4 and its alkyl derivatives is discussed. The Raman spectra of Me- and Ph-substituted hydrazines and of $(NH{\cdot}CO_2Et)_2$ have been determined.

LXXVII. The Raman spectra of substituted derivatives of PhCHO, EtOBz, and of BzCl have been determined. The results are discussed in relation to the C:O frequency. For OH-derivatives of PhCHO and OH- and NH_2-derivatives of EtOBz the results suggest that in the *o*-compounds intramol. H bridges are present, and that the *m*- and *p*-derivatives are associated, owing to the presence of intermol. H bridges. Substituted derivatives of BzCl are associated, H atoms of the ring apparently being capable in certain circumstances of constituting intermol. bridges. R. C.

Raman effect. LXXVIII. Nitrogen compounds. VIII. Nitriles. A. W. Reitz and R. Sabathy (Monatsh., 1937, **71**, 100—108; cf. A., 1937, I, 497).—Data are recorded for *n*-butyro-, methylethylaceto-, α-hydroxy*iso*butyro-, *n*- and *iso*-hexo-, diethylaceto-, α-hydroxy*iso*valero-, *n*-hepto-, and β-chloro-*n*-butyro-nitriles and methylethylacetaldoxime. Constitutive influences in these spectra and their relationships to those of C_2H_2 derivatives are discussed. J. W. S.

Photoluminescence of solutions of rare-earth salts. J. Larionov and A. Seidel (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 443—445).—Dil. (0·1 0·3%) solutions of Gd salts give a bright narrow photoluminescent band at 3110 A., corresponding with one of the absorption bands of Gd solutions, the excitation region lying between 2400 and 2700 A. The band at 3108 A. previously detected in solutions of Eu salts is ascribed to the presence of traces of Gd. The application of photoluminescence to analysis is discussed. C. R. H.

Fluorescence of bivalent rare earths. Colouring and luminescence under the influence of Becquerel rays. K. Przibram (Z. Physik, 1937, **107**, 709—712; cf. A., 1936, 1321).—Recent work on the fluorescence bands of Sm and Tu is discussed. H. C. G.

Fluorescence of octahydrofluorocyclene. S. Pienkowski (Bull. Acad. Polonaise, 1937, **A**, 269—277).—The fluorescence spectrum of octahydrofluorocyclene ($C_{14}H_{36}$) has been measured in the vapour and solid state and in solution in C_6H_6, *o*-, *m*-, *p*-xylene, AcOH, CCl_4, $CHCl_3$, etc., using Hg light λλ 4358—3650 A. Bands are observed at ~ 5350, 5426, 4660, 4400, and 4150 A. The thermal decomp. is discussed. F. J. L.

Fluorescence and absorption of diacenaphthylidene. B. Twarowska (Bull. Acad. Polonaise, 1937, **A**, 278—284).—The fluorescence spectrum of "red" diacenaphthylidene (I) [obtained by heating the hydrocarbon (II) at 300°] in *o*-xylene is identical with that of (II) but the spectra of the crystals are different; it is probably a dimorphic form. The absorption spectrum of gaseous (I) has four bands λλ 3740, 3665, 3525, 3480 A. corresponding with the absorption bands of (II) and a region of fine structure λλ 3338—3150 A. corresponding with the absorption band in acenaphthene. F. J. L.

Dependence of fluorescence yield of diacenaphthylidene solution on the wave-length of the exciting light. (Mlle.) Z. Lewkowicz (Bull. Acad. Polonaise, 1937, **A**, 285—294).—The intensity of the fluorescence spectrum of the hydrocarbon in C_6H_6 has been measured. The fluorescence yields for the lines λλ 4035, 3805, 3605, 3418 A. are 1, 2·3, 7·8, and 30·9, respectively. F. J. L.

Method of determination of the real fluorescence polarisation of solutions at high concentrations. S. I. Vavilov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 255—258).—Theoretical. A method of calculating the fluorescence polarisation of solutions of high concn. is outlined for the conditions (*a*) the absorption and fluorescence spectra independent of concn., (*b*) the thickness of the liquid layer is sufficient to absorb all the exciting light. F. J. L.

Fluorescence polarisation of solutions at high concentration. S. I. Vavilov, P. G. Gluchov, and I. A. Chvostikov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 259—261; cf. preceding abstract).—The fluorescence polarisation of solutions in glycerol, concn. 10^{-5}—10^{-2} g. per c.c., using exciting λ 4900 A. has been measured at temp. 20—70°. F. J. L.

Study of fluorescence in layers of thickness comparable with the wave-length. F. S. Barisanskaja (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 99—102).—The dependence of the intensity of the fluorescent light on the concn. of fluorescein (H_2O or MeOH solution) in the film is examined and discussed. K. S.

Dichroism of flowing [solutions of] dyes. S. Nikitin (Compt. rend., 1937, **205**, 1058—1060; cf. A., 1937, 1, 317).—Dichroism is due to anisotropic orientation of the mols. when flowing, and the coeff. of absorption of the incident light then depends on the direction of vibration of the incident beam. From the absorption in different directions of the radiation, dichroism is measured. J. A. D.

Phenomena of chemiluminescence, in the visible spectrum, of molecules containing an amide group. C. Courtot and A. Bernanose (Compt. rend., 1937, **205**, 989—991).—Amide or hydrazide groups in an aromatic ring produce chemiluminescence when oxidised with H_2O_2 in aq. KOH. The phenomenon is not exhibited by aliphatic amides. E. S. H.

Invisible radiation emitted during chemical reactions. II. K. Jabłczyński and A. Cholewicki (Rocz. Chem., 1937, **17**, 387—391).—Radiation is observed in the reactions $2KMnO_4 + 5H_2O_2 + 4H_2SO_4 \rightarrow 2KHSO_4 + 2MnSO_4 + 8H_2O + 5O_2$, and

$2HCl + H_2O_2 \rightarrow 2H_2O + Cl_2$, but not in the reaction $2FeCl_2 + H_2O_2 + 2HCl \rightarrow 2FeCl_3 + 2H_2O$. Radiation is observed in the reaction between HCl and NaOH only at such concns. as would involve crystallisation of the NaCl formed; the effect is due to the latter process, and not to the reaction $H^{\cdot} + OH' \rightarrow H_2O$. R. T.

Variation of phosphorescence of zinc phosphors with temperature. V. ANTONOV-ROMANOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 95—98).—Measurements of the decay of the phosphorescence at temp. between 25° and 262° are recorded; the phosphorescence decreases with rising temp. K. S.

Regularities and irregularities in the ionosphere. I. E. V. APPLETON (Proc. Roy. Soc., 1937, **A**, **162**, 451—479).—Bakerian lecture. G. D. P.

Thermodynamic calculation of ionisation. K. H. RIEWE (Z. Physik, 1937, **107**, 680—682).—Saha's formula for the degree of ionisation of a gas may be derived from Planck's summation of state for a partly ionised gas. H. C. G.

Halogen films on tungsten in the surface ionisation of potassium halides. J. O. HENDRICKS, T. E. PHIPPS, and M. J. COPLEY (J. Chem. Physics, 1937, **5**, 868—872).—Mol. rays of K halides were directed in high vac. against W and $W-O_2$ surfaces and the resulting positive ion current was measured as a function of surface temp. Degrees of ionisation on O_2-free surfaces were calc. assuming each halide mol. to produce one positive ion on striking a $W-O_2$ surface. Results on O_2-free filaments at 1800—2380° K. indicate surface dissociation of the K halide followed by partial ionisation of the K atom and liberation of the halogen as an atom. In the temp. range 1600—1800° K., a progressive change in the surface with fall in temp., leading to surfaces of const. high work function, indicates the formation of halogen layers on the W. W. R. A.

Electrical and optical properties of semiconductors. XIII. G. BAUER (Ann. Physik, 1937, [v], **30**, 744).—Corrections (cf. A., 1937, I, 600).

Method of measuring the periodic internal potential of crystals. A. HAUTOT (Compt. rend., 1937, **205**, 1161—1163).—The terms $V_{a\beta\gamma}$, which are a measure of the variation of potential in the interior of a crystal lattice, can be determined by measurement of the width of electron-diffraction rings produced by the crystal. Vals. are recorded for Ni, Au, Cu_2O, and graphite; their order of magnitude is approx. ten times the vals. calc. by the Thomas–Fermi method for Ag, and by Bethe (A., 1928, 1303) for Ni. A. J. E. W.

Contact potential of the cleavage face of a zinc crystal cleaved *in vacuo*. F. B. DANIELS and M. Y. COLBY (Physical Rev., 1937, [ii], **52**, 1200).—Crystals grown in H_2, CO_2, N_2, and in vac. were cleaved in vae. by a special device and contact p.d. measured against Pt was plotted against time. After a rapid initial rise, the decrease, at 10^{-5} mm. pressure, over about 1 hr. is very small. N. M. B.

Volta effect in a vacuum. E. PERUCCA (Nuovo Cim., 1937, **14**, 310—313).—A criticism of the work of Krüger and Schulz (A., 1936, 778). O. J. W.

Initial currents in thin paraffin layers. W. SCISLOWSKI (Acta phys. polon., 1935, **4**, 123—134; Chem. Zentr., 1936, i, 4264).—The current–time characteristics for various applied voltages up to 100 kv. per cm. are discussed. Temp. has little effect in the initial current, but this increases rapidly on irradiation with γ-rays. J. S. A.

Fluorine at low temperatures. VII. Determination of dielectric constants of condensed gases. E. KANDA (Bull. Chem. Soc. Japan, 1937, **12**, 473—479).—The dielectric consts. of liquid F_2, O_2, and Cl_2 vary from 1·556 (89·51°) to 1·487 (87·62°), 1·567 (57·40°) to 1·517 (83·21°), 2·147 (208·00°) to 2·048 (239·96°), respectively, figures in parentheses being °K.; the respective mol. moments are zero. Liquid HCl varies from 11·80 (160·01°) to 9·12 (182·76°), and solid HCl from 11·01 (101·50°) to 13·06 (153·50°). The liquid has a high moment. A cryostat using H_2 vapour for temp. from 23° to 78° K. (±0·05°) is described. D. F. R.

Dielectric polarisation and form of the carbon dioxide molecule. K. L. RAMASWAMY (Current Sci., 1937, **6**, 153—154; cf. A., 1932, 216).—ϵ for CO_2 has been measured at 80—200°; the calc. polarisation vals. are const. over this temp. range, and thus do not support the theory that a transition from a straight to a bent mol. occurs at 140—145°. A. J. E. W.

Dielectric properties of solid hydrogen bromide in the transition interval near 89° K. G. DAMKÖHLER (Ann. Physik, 1938, [v], **31**, 76—96).—The variation with temp. of ϵ for HBr has been investigated between 81° and 95° K. A hysteresis effect is observed. At const. temp. ϵ varies with time but the hysteresis is unaltered. It is concluded that a rotation transition takes place in HBr at 89° K., and that the hysteresis effect is best explained by a difference in probability of rotation between the random and ordered molecular arrangements (cf. Eucken and Veith, A., 1937, I, 74). O. D. S.

Molecular association of bromobenzene and of the mono-substituted halogen derivatives of benzene. P. TRAUTTEUR (Nuovo Cim., 1937, **14**, 265—271).—Measurements of d, ϵ, and n for solutions of PhBr in C_6H_6 are recorded. The moment of PhBr is calc. to be 1·48±0·05 D. In the pure liquid about 39% of the mols. are associated. The results are discussed in relation to similar data for the F-, Cl-, and I-derivatives of C_6H_6. O. J. W.

Dipole moments of vapours. IV. Aliphatic ethers and amines. Magnitude of atomic polarisation. V. Aromatic compounds. L. G. GROVES and S. SUGDEN (J.C.S., 1937, 1779—1782, 1782—1784; cf. A., 1937, I, 115).—IV. Measurements are recorded for Me_2O, Et_2O, Pr^{α}_2O, Bu^{α}_2O, NH_2Me, $NHMe_2$, and NMe_3 and calc. moments are compared with those of Sänger (cf. A., 1932, 337). Results are analysed by the method of least squares. Data for Et_2O over 288—476° are treated in detail and considered in relation to the Debye equation.

V. Measurements for 16 compounds are recorded.

In the case of $C_6H_4Cl_2$ and $C_6H_4Cl{\cdot}NO_2$ observed moments for the *m*- and *p*-forms agree with those calc. by the simple vector addition of group moments, but the *o*-forms show large discrepancies. N. M. B.

Dipole moments of vapours. VI. Bond moments and mesomeric moments. L. G. GROVES and S. SUGDEN (J.C.S., 1937, 1992—2000).—An approx. method of calculating induced moments produced in the non-polar parts of a mol. by induction from a primary dipole, based on a method of graphical integration due to Frank (A., 1936, 150), is given. Allowing for these induced moments, experimental data for the dipole moments of aliphatic compounds yield fairly consistent bond moments for polar groups. When these are used to calculate the dipole moments of aromatic compounds, the results do not agree with those obtained experimentally. The aromatic compounds have additional moments which are the mesomeric moments corresponding with the electron drifts assumed in electronic theories of org. chemistry. All the *o*-*p*-directing groups give a large negative mesomeric moment, but the *m*-directing groups give a smaller, positive val. The results agree throughout with the direction of mesomeric moments required by considerations of org. reactions. A. J. M.

Dielectric polarisation and internal friction of *o*-, *m*-, and *p*-chloronitrobenzene in the liquid state. A. JAGIELSKI (Bull. Acad. Polonaise, 1937, **A**, 312—319).—The dielectric polarisation (p) of *o*-, *m*-, and *p*-$C_6H_4Cl{\cdot}NO_2$ has been measured at different temp. (θ). $dp/d(1/\theta)$ is 309, 716, 1500, whence the dipole moments are 6·17, 4·26 and $2{\cdot}18 \times 10^{-18}$ e.s.u., respectively. The variation of viscosity with θ indicates that the *o*- and *m*-compounds are associated and the *p*-isomeride is normal. F. J. L.

Dipole moments and molecular structure. Dipole moments of *p*-hydroxyazobenzene and its derivatives compared with those of phenol and its derivatives. F. L. WARREN (J.C.S., 1937, 1858).—Data for $Ph{\cdot}N_2{\cdot}C_6H_4{\cdot}OH$-*p* (I) and PhOH confirm those of Bergmann (cf. A., 1936, 1183). Data for PhOBz and $Ph{\cdot}N_2{\cdot}C_6H_4{\cdot}OBz$-*p* are tabulated, and results show close agreement between the moments of the corresponding C_6H_6 and azobenzene derivatives, supporting the view that (I) in C_6H_6 exists almost wholly in the azo-form. N. M. B.

Dipole moments of some aromatic diazoamino-compounds. R. J. W. LE FÈVRE and H. VINE (J.C.S., 1937, 1805—1809).—Measurements of ϵ, d, and n of solutions in C_6H_6 of diazoaminobenzene and some derivatives are given, and dipole moments are calc. Results indicate that the two aryl groups are mutually inclined at about 140°. The change with concn. of the polarisation of the parent substance is considered in relation to the nature of the association which it undergoes. N. M. B.

Refractive indexes of helium I and II. E. F. BURTON (Nature, 1937, **140**, 1015).—For He I, n_{5461} is $1{\cdot}0206 \pm 0{\cdot}0012$ and $1{\cdot}0269 \pm 0{\cdot}0004$ at 4·22° and 2·26° K., respectively. The second val. is the same as that for He II at 2·18° K. n changes by $<0{\cdot}00007$ in passing from a point in He II to a point with the same d in He I. L. S. T.

Refractivity intercept and the specific refraction equation of Newton. II. Electronic interpretation of the refractivity intercept and of the specific refraction equations of Newton, Eykman, and Lorentz–Lorenz. S. S. KURTZ, jun., and A. L. WARD (J. Franklin Inst., 1937, **224**, 697—728; cf. A., 1938, I, 13).—The refractivity equation of Eykman is superior to those of Gladstone and Dale, Lorentz and Lorenz, and Clausius and Mosotti as regards agreement with observed data for the variation of n and d of hydrocarbons, the effect of temp. on dielectric const. (ϵ) and d, and the effect of pressure on n and ϵ. The interpretation of refractive index data for hydrocarbons on the basis of the electron theory is considered. The Sellmeier–Drude equation is compared with dispersion equations based on quantum mechanics. The characteristic frequencies and the no. of dispersion electrons are calc. for hydrocarbons of different series. There is one dispersion electron per formula bond (C·C, or C·H) in saturated hydrocarbons. For unsaturated hydrocarbons the no. is <1 if all formula bonds are taken into account, but it is again 1 if only single linkings are considered. The characteristic frequencies of vibration are for paraffins $2{\cdot}95 \times 10^{15}$, for naphthenes, $2{\cdot}90 \times 10^{15}$, and for aromatic hydrocarbons, $2{\cdot}2 \times 10^{15}$. A. J. M.

Electrical birefringence of liquefied gases. R. GUILLIEN (Ann. Physique, 1937, [xi], **8**, 555—678).—A preliminary report of investigations on N_2 and O_2 (cf. A., 1937, I, 13) is amplified and extended to H_2, CH_4, and C_2H_4. In each case the calc. Kerr const. is $>$ the observed vals. The Kerr const. of liquid O_2, pure or diluted with N_2, studied with special reference to absorption, shows a variation with temp. slightly $>$ the variation predicted by Langevin's theory. Variations from the law of mixtures are small. For N_2 and C_2H_4 the temp. variation of the const. is $<$ the theoretical variation. The sp. Kerr const. of CH_4 is independent of temp., and this can be explained by quantum theory. An explanation of results on the basis of modifications of the Langevin theory as applied to liquids is examined. N. M. B.

Study of the tertiary amine oxide double linking by means of absorption spectra and rotatory dispersion. H. S. FRENCH and C. M. GENS (J. Amer. Chem. Soc., 1937, **59**, 2600—2603).—Absorption spectra for $NPhMe_2O$ and its hydrochloride, NPhMeEtO,HCl, β-$C_{10}H_7{\cdot}NMeEt$ and its oxide in EtOH solution have been determined. The rotatory dispersion of β-$C_{10}H_7{\cdot}NMeEtO$ into (but not through) the region of absorption has been measured and expressed by means of an equation. The non-homogeneity of the absorption band of the amine oxide group and its relation to the CO group are discussed. E. S. H.

Rotatory dispersion of configuratively related unsaturated secondary carbinols and their corresponding chlorides. P. A. LEVENE and A. ROTHEN (J. Chem. Physics, 1937, **5**, 980—984).—The ethylenic linking possesses a partial rotation of significant val. and this val. undergoes a periodic

change in sign as the distance of the double linking from the asymmetric centre is progressively increased. W. R. A.

Rotatory dispersion of configuratively related alkyl azides. P. A. LEVENE and A. ROTHEN (J. Chem. Physics, 1937, **5**, 985—988).—The rotatory properties of azides and corresponding halides are compared since the azide group possesses properties analogous to those of the halogen atoms. The correlation of the primary and secondary azides is discussed. Partial rotations of the azide group and of the halogen atom may be of opposite sign in configuratively related substances. In a homologous series of secondary azides the rotation in the visible region and the partial rotation of the azide group unexpectedly change sign in passing from the second to the third member; a tentative explanation is given. The absorption band at 2880 A. is insignificantly, if at all, anisotropic. W. R. A.

Application of "viravals," units of affinity. J. GNEZDA (Separate, Zagreb, 1937, 25 pp.).—Assuming the tervalency of H, diagrams of supposed structure, based on the conception of "viravals" (cf. A., 1933, 450), are assigned to many inorg. compounds. F. L. U.

Structure of boron hydrides. M. M. PLATONOV (J. Gen. Chem. Russ., 1937, **7**, 1567—1571).—Theoretical. The hydrides of B are represented as being composed of the dipolar elements $B^{III}H_3$ and $B^{I}H$. R. T.

Properties of ions. III. Theory of isomerisation of complex compounds. B. V. NEKRASSOV (J. Gen. Chem. Russ., 1937, **7**, 1594—1609; cf. A., 1936, 401).—In equilibrium mixtures of geometrical isomerides of Pt or Co complexes the dominating isomeride is distinguished by the *trans*-position of the most labile substituent to that one which most strongly polarises the central atom. R. T.

Constitution of complex metallic salts. VI. Phosphine and arsine derivatives of silver and aurous halides. Configuration of co-ordinated argentous and aurous complex. F. G. MANN, A. F. WELLS, and D. PURDIE (J.C.S., 1937, 1828—1836).—The trialkyl-phosphine and -arsine derivatives of AgI possess four-fold macro-mols., $[R_3P(As)\rightarrow AgI]_4$, having the same structure and configuration as the Cu_2I derivatives previously described (cf. A., 1937, I, 15). Hence the 4-covalent Ag^I complex is tetrahedral, and the 3-covalent I atom can be regarded as being at one apex of a tetrahedron with its three valencies directed towards the remaining apices. The phosphine and arsine derivatives of the Au^I halides are unimol., $[R_3P(As)\rightarrow AuX]$, and the 2-covalent aurous complex is probably linear. The PH_3–Au compounds are stable and can be distilled without decomp. The electronic significance of the results is discussed. The following are described: *tetrakis(monoiodotrialkylphosphinesilver)*, $[R_3P\rightarrow AgI]_4$, R = *Et*, m.p. 208—209°, *Pr*^{a}, m.p. 258—265°, *Bu*^{a}, m.p. 43°; *tetrakis(monoiodotrialkylarsinesilver)*, $[R_3As\rightarrow AgI]_4$, R = *Et*, m.p. 182—185°, *Pr*^{a}, m.p. 219—221° (decomp.); *monohalogenotrialkylphosphinegold*, $[R_3P\rightarrow AuX]$, R = *Et*, X = *I*, m.p. 67°, b.p. 195—200°/0·03 mm.; R = *Pr*^{a}, X = *Cl*, m.p. 40°, b.p. 205—207°/0·04 mm.; R = *Bu*^{a}, X = *Cl*, b.p. 215—225°/0·03 mm.; R = *Bu*^{a}, X = *I*, b.p. 220—225°/0·2 mm.; *monohalogenotrialkylarsinegold*, $[R_3As\rightarrow AuX]$, R = *Me*, X = *Cl*, m.p. 165—175° (decomp.), X = *I*, m.p. 176—178° (decomp.), and X = *CNS*, m.p. 127—128° (decomp.) when rapidly heated; R = *Et*, X = *Cl*, m.p. 94—95°, and X = *I*, m.p. 77° (slight decomp.); *monochlorodiethylsulphinegold*, $[Et_2S\rightarrow AuCl]$, m.p. 38—40° (slight decomp.). N. M. B.

New conception of chemical inertia. P. RENARD (Compt. rend., 1937, **205**, 1068—1070).—Mechanical analogies, involving time rate of change of states, are considered. J. A. D.

Molecular interaction and chemical affinity. P. GIRARD and P. ABADIE (J. Phys. Radium, 1937, [vii], **8**, 439—445; cf. A., 1936, 666).—The times of relaxation of dipolar mols. indicate that in addition to van der Waals forces there are two important factors which have to be taken into account. One arises from the fact that in certain mols. the C valencies are not satisfied, and the second is due to chemical affinity existing between two types of mols. W. R. A.

Energetical interpretation of the semipolar double bond. R. SAMUEL (Proc. Indian Acad. Sci., 1937, **6**, **A**, 257—265).—Theoretical. The formation of SO_3 is not brought about by the combination of unexcited SO_2 in its ground state $^1\Sigma$ plus unexcited O atoms in the ^3P term; the SO_2 is in an excited state 4·3 e.v. above the ground state. The same conditions hold in the corresponding N mols., and it is considered that this affords evidence against the existence of co-ordinate links in simple inorg. mols. of the first order. F. J. L.

Determination of linking moments from infra-red absorption measurements. R. MECKE (Z. Physik, 1937, **107**, 595—598).—Previously derived equations (A., 1936, 1052) are tested with existing data for H_2O and HCl. The dipole bond moments, μ_{OH} and μ_{HCl}, so calc. are in good agreement with vals. from electrical measurements. L. G. G.

Mechanical analyser for the solution of secular equations and the calculation of molecular vibration frequencies. D. P. MACDOUGALL and E. B. WILSON, jun. (J. Chem. Physics, 1937, **5**, 940—944).—A set of coupled harmonic oscillators has been constructed in such a way that it can be used to solve the numerical secular equations which occur in the theory of the vibration of polyat. mols. Details of the construction and operation of the apparatus are given. W. R. A.

Force constants and molecular structure H. W. THOMPSON and J. W. LINNETT (Nature, 1937, **140**, 1065; cf. A., 1937, I, 500).—The force-consts. of the linkings in the mol. of C_3O_2 have been recalc. using additional data (*ibid.*, 495) on the infra-red spectrum. The new vals. strengthen the view that the bonds are intermediate between double and triple, and that the mol. is a resonance hybrid. L. S. T.

Relation between frequency and reduced mass in diatomic molecules. A. CARRELLI and P.

TRAUTTEUR (Nuovo Cim., 1937, **14**, 301—309).—Curves are given showing the relationship between fundamental frequency, ω_e, and $1/\mu$, where μ = reduced mass of the mol., for a large no. of diat. halides. For the halides of each group in the periodic table the points lie either wholly on a parabola for which $\omega_e c\mu$ = const., or partly also on a straight line for which $\omega_e c\sqrt{\mu}$ = const. These results, when combined with the empirical relationships of Allen and Longair (A., 1935, 685) or of Badger (A., 1934, 477), show that r_e^3, the equilibrium interat. distance, is const. for the linear and $\propto \mu^{\frac{1}{3}}$ for the parabolic portions of the afore-mentioned curves. O. J. W.

Additive properties of log γ/L, and the calculation of molecular radius. G. L. STAROBINETZ and V. F. ROMISCH (J. Gen. Chem. Russ., 1937, **7**, 2022—2025).—The radius of mols. is given by $0{\cdot}067L/\gamma$, where L is the mol. heat of vaporisation, and γ is the surface tension at the b.p. R. T.

Molecular attraction in liquids at the b.p. under constant pressure. G. DUCH (J. Chim. phys., 1937, **34**, 649—690; cf. A., 1937, I, 291; 1936, 787).—Treatment of a liquid as an aggregate in hexagonal close-packing of effectively spherical mols. (radius r) subject to mutual forces $F = k^n m^2 d^{-n}$ (m = mass, d = inter-distance of mols., k, n, parameters) permits expression of k, n, and mechanochemical quantities in terms of γ, r, m, or γ, ρ, M (γ = surface tension, ρ = density, M = mol. wt.). From measurements of γ and ρ, for aromatic liquids, at the b.p./745 mm. $n = 5{\cdot}82$, and confirmation of the relation $\gamma^3 . d^{-(n+1)} . M^{n-5}$ = const. gives a method of finding mol. wts. Extension of this relation to homologous series shows $5 < n < 6{\cdot}5$, n increasing in the order: formates < ethers < alcohols < aromatic hydrocarbons < *cyclo*hexane < *n*-paraffins. The calc. surface energy of disruption of 1 mol. (aromatic series) $\doteqdot L/4$ and is discussed with reference to the Eötvös const. and the Ramsay–Shields relation. I. McA.

Structure of H_3, H_3^+, and H_3^-. IV. D. STEVENSON and J. HIRSCHFELDER (J. Chem. Physics, 1937, **5**, 933—940; cf. A., 1937, I, 551).—Mathematical. An extension of previous work on H_3 and H_3^+ to include calculation of the force const. for binding the linear H_3 and H_3^+. The energy of linear H_3^- has been calc.; the val. indicates that it is energetically unstable with respect to $H_2 + H^-$ and therefore incapable of being observed experimentally. W. R. A.

Calculation of the important constants of metallic strontium and barium. P. GOMBÁS and G. PÉTER (Z. Physik, 1937, **107**, 656—661; cf. A., 1936, 925; 1937, I, 224).—Theoretical. Lattice consts. and energy and heat of sublimation are calc. by means of a statistical approximation method without the help of empirical or semi-empirical parameters. L. G. G.

Diffusion in condensed systems. H. MARK and R. SIMHA (Naturwiss., 1937, **25**, 833—834).—Theoretical. Some of the results obtained by Rabinovitch (A., 1937, I, 568) are improved by modifications in the method of calculation. A. J. M.

Revised calculation of the translational fluctuation effect in gaseous dielectrics. J. H. VAN VLECK (J. Chem. Physics, 1937, **5**, 991).—A revised quantum-mechanical calculation substantiates the formula of Kirkwood (A., 1936, 1321) previously criticised (A., 1937, I, 446). W. R. A.

Solid indicators for direct detection of photodissociation products. H. NEUJMIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 447—450).—An amorphous deposit of MoO_3 is a sensitive indicator for the presence of H atoms produced by photodissociation, an intense blue colour being produced. The indicator has been used to study the photodissociation of vapours of H_2O, NH_3, and alcohols. The data for H_2O vapour suggest that dissociation follows $H_2O + h\nu \rightarrow H + OH$ rather than $H_2O + h\nu \rightarrow H_2 + O$ (in ^1D state). Similarly, the photodissociation of NH_3 appears to follow $NH_3 + h\nu \rightarrow NH_2 + H$ rather than $NH_3 + h\nu \rightarrow NH + H_2$. The formation of H atoms from alcohols is slight and may be due to the presence of H_2O or to secondary reactions. C. R. H.

Fluorine at low temperatures. VI. Surface tension of liquid fluorine [and oxygen]. E. KANDA (Bull. Chem. Soc. Japan, 1937, **12**, 469—472).—The surface tension of liquid F_2 from 57·1° to 84·9° K. varies from 14·61 to 9·85 and of liquid O_2 from 58·1° to 89·5° K. varies from 21·25 to 13·55 dynes per cm. measured by the capillary-rise method. D. F. R.

Fundamentals of crystal optics. IV. General dispersion condition, especially for *X*-ray fields. P. P. EWALD (Z. Krist., 1937, **97**, 1—27).—Mathematical. A comprehensive treatment of the dynamic interference theory. I. McA.

Precision determination of lattice constants by the Debye–Scherrer method. K. MOELLER (Z. Krist., 1937, **97**, 170—196; cf. A., 1933, 213).—Sources of error, methods of correction, and previous results in precision measurements are critically reviewed. Using Wyckoff's method, technique and results are given for Ag, Pt, LiF, NaCl, and TlCl, proposed as calibration standards. Variations in the "constants" derived from different planes are discussed in terms of the deviation from Bragg's law; these are greatest for well-defined crystallite surfaces and larger grain-size (20 μ.), but at. no. has little effect. The ultimate preferred vals. for a are at 25°: Ag, 4·07800; NaCl, 5·6261, 5·6283; TlCl, 3·8340 A.; at 20°: Pt, 3·9145; LiF, 4·0198, 4·0199 A. W, 3·1588 A.; these confirm vals. calc. from d and mol. wt. I. McA.

Intensity distribution of Debye rings due to various fibre structures. III. Distribution of microcrystals in regenerated silk fibres. C. MATANO (J. Soc. Chem. Ind. Japan, 1937, **40**, 358—360B).—Mathematical. The theory previously developed is extended and applied to the analysis of *X*-ray diffraction patterns of regenerated silk fibres (cf. A., 1937, I, 118). C. R. H.

Resolving power in *X*-ray spectra. V. DOLEJŠEK and M. TAYERLE (Compt. rend., 1937, **205**, 1143—1145; cf. A., 1935, 3, 686).—High resolving power has been obtained in a single-grating instrument of

moderate dimensions, using a curved gypsum crystal (A., 1938, I, 100) as grating A. J. E. W.

Fine structure of X-ray absorption edges as an aid in crystal structure determination. F. SCHOSZBERGER (Monatsh., 1937, **71**, 109—121).—The application of the fine structures of the *X*-ray absorption edges of metals to the determination of structure factors and parameter vals. is discussed. J. W. S.

Grain-like structure of solids. (SIR) W. BRAGG (Nature, 1937, **140**, 954—956).—A lecture. L. S. T.

Interference theory. M. RENNINGER (Z. Krist., 1937, **97**, 95—106).—Theoretical. For unsymmetric Bragg reflexion of *X*-rays from a plane crystal surface, expressions are derived relating the glancing angle θ and the integrated reflexions R for ideal and mosaic crystals to the angle ϕ between the crystal surface and reflecting lattice planes. Vals. of R for ideal and mosaic crystals are discussed for low vals. of the structure factor. The results are applied to the (222) reflexion of diamond. I. McA.

***X*-Ray study on the distribution of charge in the diamond lattice.** M. RENNINGER (Z. Krist., 1937, **97**, 107—121; cf. A., 1936, 128).—Abs. intensities for the (111), (311), (222) planes of diamond, using Cu $K\alpha$ rays, are measured by Bragg reflexion from the octahedral surface and compared with theory and previous experiment. For the forbidden (222) reflexion involving "indirect" excitation (A., 1937, I, 117), $F_{222} = 1{\cdot}1$ electrons per cell, still 4 times the calc. val. of Ewald and Hönl (A., 1936, 412, 1185). With Mo $K\alpha$ rays the forbidden (622) reflexion is not observed, whence F_{622} is $<0{\cdot}2$ electron per cell. I. McA.

Unit cell and space-group of monoclinic sulphur. J. T. BURWELL III (Z. Krist., 1937, **97**, 123—124).—The unit cell contains 48 atoms, possibly as puckered-ring S_8 mols. (A., 1935, 285), and has a 10·90, b 10·96, c 11·02 A., β 83° 16′. The space-group is C_{2h}^5 ($P2_1/a$). I. McA.

Structure of metals. A. MÜLLER (Nature, 1937, **140**, 1011—1012).—*X*-Ray photographs from Ni and Au discs under conditions of high dispersion, using the β_1-line of Fe and the α_2-line of Ni, respectively, as incident radiations, show that sharp reflexions from individual crystal grains are obtained, but they are scattered over a wide range indicating lattice variations of the individual crystals of the order of 1 in 10^3 to 1 in 2×10^3. Precision data on lattice dimensions for metals are thus to be regarded as statistical averages of figures varying over this comparatively wide range, and the reproducibility of the lattice const. of an individual grain is $\ll$ that of the average. The ordinary process of annealing is probably incapable of producing equilibrium among the crystal grains. L. S. T.

Crystal structure of some intermetallic compounds of the rare earths. A. IANDELLI and E. BOTTI (Gazzetta, 1937, **67**, 638—644).—An *X*-ray investigation of the systems A–B (A = La, Ce, Pr; B = Zn, Cd, Hg) containing 50 at.-% of each metal. The Zn and Cd alloys consist of a single cube-centred phase, with the vals. of a for LaZn 3·766, CeZn 3·706, PrZn 3·712, LaCd 3·966, CeCd 3·908, PrCd 3·913 A. The Hg alloys consist of two or more phases, and are readily oxidised on exposure to air, the Ce amalgam being spontaneously inflammable. O. J. W.

Cobalt and the cobalt–carbon system. W. F. MEYER (Z. Krist., 1937, **97**, 145—169).—Pressed Co rods, heat-treated in the range 0—1200°, alone or in a stream of C_6H_6 vapour or coal gas, were *X*-rayed. Hexagonal and cubic forms of Co with transition point 467° are confirmed. Hendricks' transition point at ~1100° is unconfirmed; above 900° only the cubic form exists. Coexistence of forms, time-lag in transition, quality of spectra, results of mechanical treatment, and thermodynamical considerations indicate that a lattice deformation hinders the glide-plane transition. With coal gas at 230—470°, Co catalyses the decomp. of CO and forms with C an unstable brown mixed crystal the *X*-ray spectrum of which is that of Co. At 500—800° the stable *carbide*, Co_3C,, isomorphous with Fe_3C, is formed; the rhombic cell has a 4·52, b 5·08, c 6·73 A. Above 800°, only Co forms exist. I. McA.

Structure of zirconium silicide, $ZrSi_2$. S. VON NÁRAY-SZABÓ (Z. Krist., 1937, **97**, 223—228).—A complete and corr. analysis is made of Seyfarth's data (A., 1929, 18). The rhombic cell has a 3·72, b 14·61, c 3·67 A., 4 $ZrSi_2$ in cell, space-group D_{2h}^{17} (*Cmcm*). In a non-ionic layer-lattice structure, 4 Zr, 4 Si_I, and 4 Si_{II} occupy the positions: $(0,y,\frac{1}{4})$, $(0,\bar{y},\frac{3}{4})$, $(\frac{1}{2},\frac{1}{2}+y,\frac{1}{4})$, $(\frac{1}{2},\frac{1}{2}-y,\frac{3}{4})$ where $y = 0{\cdot}106$, 0·750, 0·355 respectively. Interat. distances are given. I. McA.

***X*-Ray determination of the structure of liquids and glass.** B. E. WARREN (J. Appl. Physics, 1937, **8**, 645—654).—A review of the methods of *X*-ray analysis applied to liquids. Vitreous SiO_2, liquid Na, and H_2O are particularly considered. Although liquids show a structure this is not to be interpreted as a cryst. structure. A. J. M.

Structure of glass. A. GANGULI (Z. Krist., 1937, **97**, 88—90).—A review of factors involved in the formation and stability of states of matter, including glass. I. McA.

Crystal structure of "β-alumina," $Na_2O,11Al_2O_3$. C. A. BEEVERS and (MISS) M. A. S. ROSS (Z. Krist., 1937, **97**, 59—66; cf. B., 1936, 1091). The isomorphous $Na_2O,11Al_2O_3$ and $K_2O,11Al_2O_3$ are hexagonal with a 5·584, c 22·45 A. and a 5·584, c 22·67 A., respectively; space-groups are $C6/mmc$ (D_{6h}^4). Double Fourier synthesis of measured ($h0hl$) *X*-ray intensities leads to determination of at. parameters confirming the ideal structure of Bragg, Gottfried, and West for the Na compound. The good agreement between calc. and all available intensities, especially using the Bragg-West f-curve for O, is preferred to at. distribution and bond structure in placing the alkali atoms. Parameters and interat. distances are listed. I. McA.

Parameter of pure ferrous oxide. J. BÉNARD (Compt. rend., 1937, **205**, 912—914).—Variation in the vals. of a for FeO prepared under different conditions is attributed to the presence of dissolved

Fe. In presence of Fe_3O_4 a const. val (4·282 A.) is obtained under all conditions. A. J. E. W.

Structure of the so-called antimony tetroxide and of the isomorphous compound $BiTa_2O_6F$. K. Dihlström and A. Westgren (Z. anorg. Chem., 1937, **235**, 153—160).—The so-called Sb_2O_4 is $Sb^{III}O{\cdot}OH,Sb^{V}_2O_5$. It is face-centred cubic, *a* 10·28 A., but the unit cube contains 8 Sb_3O_6OH and not 16 Sb_2O_4 (cf. A., 1928, 821; 1933, 692); the space-group is O_h^7. An isomorphous *compound*, $BiTa_2O_6F$, has been obtained by heating BiOF with Ta_2O_5; it has *a* 10·46 A. F. J. G.

Sphero-crystals. E. von Lengyel (Z. Krist., 1937, **97**, 67—87).—As in natural minerals, sphero-crystals of oxy-salts are obtainable. Growth, structure, and optical properties of those from aq. solutions of $NaHCO_3$, $CaCO_3$, $MnSO_4,4H_2O$, $Na_2S_2O_3,5H_2O$, $K_2Cr_2O_7$, and $Na_2C_2O_4$ are given and illustrated by photomicrographs. The rôle of the favourable factors, high temp., speed of evaporation, and dehydration, is discussed. I. McA.

Law of intergrowth and blending mechanism in anomalous mixed crystals of the iron ammonium chloride type. A. Neuhaus (Z. Krist., 1937, **97**, 28—58; cf. A., 1936, 1477; 1937, 1, 118).—$CoCl_2,2H_2O$ is monoclinic pseudo-orthorhombic with *a* 7·15, *b* 8·47, *c* 3·60 A.; *d* (*X*-ray) 2·52. From cell data and measured optical properties, including *n* and pleochroism, for $CoCl_2,2H_2O$, $CuCl_2,2H_2O$, and $CuCl_2,2NH_4Cl,2H_2O$, the Co salt has Harker's $CuCl_2,2H_2O$ structure (A., 1936, 1327). Geometric and structural comparisons for NH_4Cl and $CoCl_2,2H_2O$ with extensive optical examination of $CoCl_2,2NH_4Cl,2H_2O$ indicate a simple salt combination in the mixed crystal so that the {100}, {110}, {210} forms of NH_4Cl correspond respectively with the {441}, {1$\bar{1}$1}, {441} of $CoCl_2,2H_2O$, axial directions being mutually inclined, not parallel as in isomorphous mixtures. Mechanisms based on ionic, covalent, and van der Waals forces are discussed. The evidence, together with the facts of stability, solubility, and cohesion, supports that based on intercalation of simple salts with a tendency to complex formation, the forces beingi ntermediate to van der Waals and at. linking. I. McA.

Space-group of $BaCl_2,2H_2O$. S. von Náray-Szabó and K. Sasvári (Z. Krist., 1937, **97**, 235—237).—From 30° oscillation *X*-ray photographs, the monoclinic cell contains 4 mols. and has *a* 6·69, *b* 10·86, *c* 7·15 A., β (Groth) 91° 5′; space-group C_{2h}^5, $P2_1/n$. Indexed reflexions with intensities are listed; from the (0*k*0), (*hk*0) series, $y_{Ba} = 0{\cdot}16—0{\cdot}17$. I. McA.

Crystal structure of potassium metaborate, $K_3(B_3O_6)$. W. H. Zachariasen (J. Chem. Physics, 1937, **5**, 919—922).—From *X*-ray evidence crystals of KBO_2 are rhombohedral and contain six mols. of KBO_2; density = 2·348. The space-group and other structural features, including interat. distances, are given. The metaborate radical is $(B_3O_6)^{-3}$, a ring of BO_3 triangles instead of the endless chain of BO_3 triangles found in CaB_2O_4. The BO_3 groups are slightly distorted, the nine atoms lie in one plane, and the K atoms are surrounded by seven O. W. R. A.

Crystallographic study of potassium nickelocyanide trihydrate. H. Brasseur and A. de Rassenfosse (Z. Krist., 1937, **97**, 239—240).—*X*-Ray spacings and vals. of *n* are given for a triclinic pseudohexagonal cell. I. McA.

Rotation in molecular lattices. C. Finbak (Tids. Kjemi, 1937, **17**, 145—146).—*X*-Ray analyses of the cryst. modifications of CBr_4 stable above 46°, $C(CH_2{\cdot}OH)_4$ above 179°, and C_2Cl_6 above 76° show that free rotation occurs about the central atom in the first two cases and unsymmetrically in the last. M. H. M. A.

Crystal and molecular structure of carbon tetraiodide and tetrabromide. H. Mark (Z. physikal. Chem., 1937, **B**, **38**, 209—210).—Comments on Finbak and Hassel's paper (A., 1937, I, 502). R. C.

***X*-Ray analysis of the dibenzyl series. IV. Detailed structure of stilbene.** J. M. Robertson and I. Woodward (Proc. Roy. Soc., 1937, **A**, **162**, 568—583).—Stilbene, m.p. 124°, crystallises in the monoclinic prismatic system. The unit cell, containing 4 mols., has parameters *a* 12·35, *b* 5·70, *c* 15·92 A., β 114·0°; $d_{calc.}$ 1·161. Fourier synthesis shows that the mols. are nearly, perhaps exactly, planar which may be attributed to conjugation of the central double linking with the Ph rings. The orientation of the mol. is given and the intermol. distances are discussed. The single linkings emerging from the Ph ring have a length only 1·44 A., indicating some double linking character in this linking. G. D. P.

Non-planar aromatic molecules. (Mrs.) K. Lonsdale (Z. Krist., 1937, **97**, 91—94).—The mol. in cryst. *s*-$C_6H_3Ph_3$ is not planar. A structure of plane hexagons having the Ph groups rotated in the same sense 25° from the plane of the central ring reconciles magnetic susceptibilities and certain *X*-ray intensities. Published results are surveyed. I. McA.

***X*-Ray investigation of the crystals of acenaphthene.** M. Prasad and L. A. De Sousa (Current Sci., 1937, **6**, 220).—Rotation photographs give *a* 8·31, *b* 14·07, *c* 7·21 A.; space-group C_h^5; 4·017 mols. per unit cell (cf. A., 1937, I, 289). L. S. T.

Structure of crystallised azulene. L. Misch and A. J. A. van der Wyk (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 106—108).—The parameters, obtained by *X*-ray analysis, are: *a* 7·86, *b* 6·02, *c* 7·91 A.; β 75°. The unit cell contains 2 mols., which are situated with their length parallel to the *c*-axis. Space-group C_{2h}^2 or C_2^2, the former being most probable. The cleavage plane is parallel to *bc*. A. J. E. W.

Triangular sugar crystals. J. Schmutzer (Proc. Akad. Wetensch. Amsterdam, 1937, **40**, 800—802).—A 65% sucrose solution was repeatedly boiled with decolorising C or "hyflocel," filtered, and eventually evaporated until supersaturated at 60 mm. After seeding, crystallisation was considerably delayed and the sugar separated in characteristic triangular

crystals, $p:p' = 79°$, $p:q' = 113°$, $p':q = 128°$, $p:a = 50°\ 30'$, $a:s = 32°$, $s:q = 60°$, $a:q = 78°$, having a lamellar structure parallel to faces *s* and *p*. The crystals show the normal optical properties, axial ratios, and β. S. C.

Crystalline structure of uranium. C. W. JACOB and B. E. WARREN (J. Amer. Chem. Soc., 1937, **59**, 2588—2591).—*X*-Ray examination indicates an orthorhombic unit cell having *a* 2·852, *b* 5·865, and *c* 4·945 A. The space group is V_h^{17} *Cmcn*, parameter 0·105±0·005, and *d* (*X*-ray) 18·97. E. S. H.

Structure of pepsin.—See A., III, 73.

Liquid crystals obtained by sublimation. P. GAUBERT (Compt. rend., 1937, **205**, 997—998).—The sublimate of *p*-azoxyanisole forms isotropic or anisotropic droplets according to the temp. of vaporisation and of condensation. The orientation of the liquid crystals is probably influenced by impurities on the surface of condensation. E. S. H.

Properties of an electron bundle of uniform velocity after penetration of a thin foil. F. KIRCHNER (Ann. Physik, 1937, [v], **30**, 683—687).—Velocity losses of from 1 to 3·5% were observed in an electron bundle of 45 kv. velocity after passage through thin (1 to 3·2 μ.) sheets of Al and mica. The conclusions of Trillat and Hautot (A., 1937, I, 541) are criticised. O. D. S.

Electron-diffraction study of the grain boundaries in iron. R. MORGAN, (MISS) S. STECKLER, and B. L. MILLER (J. Chem. Physics, 1937, **5**, 953—959).—When untreated and heat-treated transformer Fe and heat-treated electro-deposited Fe were dissolved in $(NH_4)_2S_2O_8$ only the last specimen left residues suitable for investigation by electron diffraction. The presence of Fe_3C and α-FeO·OH in the grain boundaries was identified. The α-FeO·OH presumably results from chemical action between the $(NH_4)_2S_2O_8$ and either Fe or Fe oxide originally present in the grain boundary. W. R. A.

Electron study of the effect of heat on the structure of gold leaf. G. L. CLARK and E. WOLTHUIS (J. Appl. Physics, 1937, **8**, 630—638).—The construction of an electron diffraction apparatus suitable for both reflexion and transmission is described. The diffraction pattern of commercial Au leaf shows that the (100) faces of the crystallites lie in the surface of the leaf. The pattern is unaltered by heating the leaf in an O_2-free atm. to 450°, but when O_2 is present a many-ringed pattern is produced which reverts to the original on heating the leaf in vac. at 400° for 8 hr. The many-ringed pattern is probably due to the formation of the oxide, which is decomposed on heating in vac. F. J. L.

Electron-diffraction investigation of nitrosyl chloride and nitrosyl bromide. J. A. A. KETELAAR and K. J. PALMER (J. Amer. Chem. Soc., 1937, **59**, 2629—2633).—Interat. distances recorded are: (*a*) for NOCl, Cl—O 2·65±0·01, Cl—N 1·95±0·01, N—O 1·14±0·02 A.; (*b*) for NOBr, Br—O 2·85±0·02, Br—N 2·14±0·02, N—O 1·15±0·04 A. The angles Cl–N–O and Br–N–O are 116±2° and 117±3°, respectively. The large halogen—N distances are ascribed to resonance between the normal covalent and ionic structures. E. S. H.

Volume anomaly of ferromagnetic substances. A. D. SAMURCAS (Bull. Soc. roum. Phys., **36**, No. 63—64, 125—130; Chem. Zentr., 1936, i, 4120—4121).—Forrer's theory of the anomalous vol. changes at the Curie point (A., 1934, 835) is in better agreement with experiment than is Bauer's, since in Fe–Si alloys negative discontinuities or continuous vol. changes may occur, according to the [Si]. J. S. A.

Technical problems of ferromagnetism in weak fields. R. GOLDSCHMIDT (Helv. phys. Acta, 1936, **9**, 33—41; Chem. Zentr., 1936, i, 4120).—The origin of the magnetic losses which are independent of amplitude and frequency is discussed. For transformer Fe, high in Si, the permeability and loss angle do not increase linearly at low fields. It is uncertain whether the effect is due to hysteresis, after-working effects, or to the effect of inclusions of different permeability. J. S. A.

Directional ferromagnetic properties of metals. R. M. BOZORTH (J. Appl. Physics, 1937, **8**, 575—588).—A review of the ferromagnetic properties of various metals and alloys, and the influence of compressive stress and temp. F. J. L.

Anisotropy of cubic ferromagnetic crystals. J. H. VAN VLECK (Physical Rev., 1937, [ii], **52**, 1178—1198).—Mathematical. N. M. B.

Variation of initial susceptibility with temperature, and of magnetostriction and reversible susceptibility with temperature and magnetisation in nickel. D. KIRKHAM (Physical Rev., 1937, [ii], **52**, 1162—1167).—Investigations previously reported (cf. Siegel, A., 1936, 785) are extended, and complete data between 21° and the Curie temp. are given. N. M. B.

Longitudinal piezoelectric effect in Rochelle salt crystals. W. G. CADY (Proc. Physical Soc., 1937, **49**, 646—653).—Experiments are described on the use as microphones, sound-emitters, piezoelectric resonators, and sources of ultrasonic waves of plates cut with their normals making equal angles with the three crystallographic axes, giving max. longitudinal effect. N. M. B.

Measurements of the optical constants of very thin metallic films. K. FÖRSTERLING (Ann. Physik, 1937, [v], **30**, 745—751).—Theoretical. A formula for the independent calculation of refractive index and film thickness from optical data is derived. O. D. S.

Method of distinguishing fast and slow waves in thick crystal plates. J. LIETZ (Z. Krist., 1937, **97**, 122).—The variation in double refraction caused by movement of an auxiliary quartz wedge over the specimen is noted, using the bands seen through a microscope with spectroscopic attachment. I. McA.

Birefringence by compression of quartz and its dispersion in the ultra-violet. G. BRUHAT and A. BLANC-LAPIERRE (Compt. rend., 1937, **205**, 807—809).—The birefringence of quartz crystals has been measured for different directions of the light

rays and for different directions of compression. The birefringence is independent of the direction of compression in the plane normal to the optic axis. R. S. B.

Phosphorus at high temperatures and pressures. R. B. JACOBS (J. Chem. Physics, 1937, **5**, 945—953).—The transition of white P into black P is irreversible and is accompanied by a "time lag" of some 12 to 15 min. White P has been heated at approx. 13,000 atm. at about 205° for six different periods, all < 15 min. and varying from each other by 2 min. intervals, then the pressure was reduced to half its highest val. in order to retain the P in the solid state, and on washing with CS_2 a C-like powder was obtained in amounts bearing a close correlation to the times of heating. Visually this powder differed from the usual black P; it had *d* 2·25 compared with 2·69. Whereas the usual black P gives distinct *X*-ray diffraction lines corresponding with an orthorhombic type of crystal structure, the "new" black P gave no diffraction lines and therefore it is either amorphous or microcryst. The differences in the total heats between the various forms of P were obtained from the heats of reaction of the different modifications with Br. These data indicated that the new black P was non-cryst. and a separate polymorphic modification and that below 560° cryst. black P is the stable form. The progression of stability of the different forms of P is discussed, as well as the time–pressure–temp. relationships during the transition of white into black P. Prolonged heating of amorphous black P at about 125° yielded a brilliant violet modification of red P. W. R. A.

Phase diagram of water to 45,000 kg. per sq. cm. P. W. BRIDGMAN (J. Chem. Physics, 1937, **5**, 964—966).—At pressures between 20,000 and 25,000 kg. per sq. cm. ice VI is transformed into ice VII. Data for the melting curves of VI and VII and for vol. changes at high pressures are given. The triple point liquid–VI–VII is at 22,400 kg. and 81·6°. Compressibilities could not be determined with high accuracy. The decrease in vol. when the liquid freezes to VII at the triple point given is practically the same as the decrease when the liquid freezes to VI at the triple point liquid–VI–V at 6380 kg. Although the curvature of the melting curve of VII is in the normal direction, there is an abnormally great increase in latent heat. W. R. A.

Melting of the mononitrophenols at high pressure. R. B. DOW and H. B. HIBSHMAN (J. Chem. Physics, 1937, **5**, 960—964).—A new dynamic high-pressure method is described and has been used to determine tho melting of mononitrophenols over a pressure range of 4000 kg. per sq. cm. Data agree well with those obtained using the piston displacement method of Bridgman. The application and utility of each method for investigating melting and polymorphic transitions of solids at high pressures are considered. W. R. A.

Complexity of the solid state of sulphur trioxide and other substances. H. GERDING and R. GERDING-KROON (Rec. trav. chim., 1937, **56**, 1229—1230).—Passages in a previous paper (A., 1937, I, 576) are explained. F. L. U.

Nature of low-temperature transformation of deuterammonium chloride. A. SMITS, G. J. MULLER, and F. A. KRÖGER (Z. physikal. Chem., 1937, **B**, **38**, 177—186; cf. A., 1936, 555).—The mol. vol.–temp. curve of ND_4Cl, which has been determined at −21·2° to −25·2°, differs considerably from that of NH_4Cl. Transformation occurs continuously and without hysteresis and increases with temp. most rapidly in a region 6·2° above the discontinuous transition temp. of NH_4Cl. These results are interpreted in terms of Smits' theory of allotropy. R. C.

Relationship of London's equation to the acceleration theory of superconductivity. F. BOPP (Z. Physik, 1937, **107**, 623—632).—A theoretical discussion of the conception underlying London's equations. L. G. G.

Electrical resistance of ferromagnetics. H. H. POTTER (Proc. Physical Soc., 1937, **49**, 671—678).—Data and resistance–temp. curves for Fe and Ni in the range 20—1200° K. are given. Results indicate that the inflexion at the Curie point is sharp to within a small fraction of a degree, and above this point the curve is concave to the temp. axis as for a paramagnetic metal; the small change in spontaneous magnetisation at low temp. has a comparatively large effect on the resistance. N. M. B.

Electrical resistance of manganese amalgams. L. F. BATES and P. G. DAY (Proc. Physical Soc., 1937, **49**, 635—641; cf. A., 1937, I, 356).—The variation of resistance with temp. of a series of amalgams was investigated over the range −78° to 340°. Curves for temp. to the ratio, resistivity difference of Hg and amalgam : resistivity of Hg are given, and an attempt is made to correlate the electrical data with previous measurements of the magnetic susceptibility of similar amalgams. N. M. B.

Magnetic properties of silver amalgams. L. F. BATES and A. W. IRELAND (Proc. Physical Soc., 1937, **49**, 642—645).—The magnetic susceptibilities of 0—5 wt.-% Ag amalgams were measured by the Gouy method; this method was found unsuitable for Au amalgams. Ag enters into solution in Hg as if it possessed mol. susceptibilities −18 to -77×10^{-6} c.g.s. units for very dil.—conc. solutions compared with the usual val. $-21{\cdot}6 \times 10^{-6}$ for solid Ag. N. M. B.

Diamagnetic susceptibilities of some complex ions. S. R. RAO and S. SRIRAMAN (Phil. Mag., 1937, [vii], **24**, 1025—1041; cf. A., 1937, I, 556). K. S.

Magnetic properties of the mercuric iodides. F. GALLAIS (Compt. rend., 1937, **205**, 1052—1054).—The Hg atom retains its diamagnetism in the compounds with I (cf. A., 1935, 592). Previous experiments indicating that a diamagnetic metal could become paramagnetic in its complex compounds are not trustworthy. J. A. D.

Magnetic susceptibility of organic liquids. Additive law. C. SĂLCEANU and D. GHEORGHIU (Bull. Soc. roum. Phys., **36**, No. 63—64, 77—81; Chem. Zentr., 1936, i, 4285—4286).—The susceptibility of mixtures of $PhNO_2$ and $COMe_2$ and of 1-$C_{10}H_7Me$ and $COMe_2$ obeys an additive law; observed

deviations of $COMe_2$–$CHCl_3$ mixtures cannot, therefore, be ascribed to dipole interaction. H. N. R.

Paramagnetic magneton numbers of the ferromagnetic metals. W. SUCKSMITH and R. R. PEARCE (Nature, 1937, **140**, 970).—The magneton nos. of Ni, Co, and Fe have been calc. from measurements of the magnetic susceptibilities of Ni and Co, and of Fe–V alloys. With Fe, the V removes the γ-phase and the $1/\chi$–T curve is linear above 900°. The curve for the δ-phase of Fe is linear, and when extrapolated to lower temp. joins the α-phase at the A3 transformation. The val. for the magneton no. thus obtained (3·15) agrees with that determined from the alloys. The susceptibility curve for Co is linear between 1230° and 1450°. Continued annealing of the specimens produced parallel but displaced lines, tending to lower the paramagnetic Curie point. The curve for Ni is linear between 500° and 925°, above which the slope decreases. L. S. T.

Ferromagnetic and electrical properties. VII. Thermoelectric power, Thomson coefficient, and heat conductivity of nickel. A. HAMMER (Ann. Physik, 1937, [v], **30**, 728—744).—The variation with temp. of the differential thermoelectric power of Ni against Cu, and of the thermal conductivity of Ni, have been measured, by differential methods, between room temp. and 470° and between room temp. and 420°, respectively. The Thomson coeff. is calc. and the ferromagnetic anomaly of Ni discussed. An anomalous increase in thermal conductivity was observed near the Curie point of Ni. O. D. S.

Influence of a longitudinal magnetic field on the thermoelectric power of nickel and some ferronickels, under tension. G. SIMON and J. BOUCHARD (Compt. rend., 1937, **205**, 1141—1143).—The variation of the e.m.f. for different vals. of H, the tension in the wires forming the couple, and the temp. difference between the junctions, is described for couples of Cu with Ni and five Ni–Fe alloys. A. J. E. W.

Acoustic velocity in organic compounds. S. PARTHASARATHY (Current Sci., 1937, **6**, 213).—The acoustic velocities of *d*- and *l*-pinene are identical at 24°, and are comparable with those of aliphatic and not aromatic compounds. Data for PhEt, Ph_2O, indene, and Et lactate are also given. L. S. T.

Experimental determination of ultrasonic velocity in several gases at pressures between one and one hundred atmospheres. A. H. HODGE (J. Chem. Physics, 1937, **5**, 974—977).—A resonator type of acoustic interferometer suitable for studying the behaviour of ultrasonic waves in gases at pressures up to several hundred atm. is described and the variations in the acoustic velocities of several gases with changes of frequency and pressure are recorded. The availability of the method for indirect determination of sp. heat is discussed. W. R. A.

Comparison of specific heats of gases at elevated temperatures. A. POTOP (Compt. rend., 1937, **205**, 1047—1049).—A flow method (cf. Henry, A., 1931, 1361) of comparing the sp. heat of gases up to 600° is described. The apparatus consisted of a Pt tube electrically heated inside a duralumin container, and the axial asymmetry of temp. gradient along the tube was used to indicate the relative sp. heats of the gases. J. A. D.

Ratio of the specific heats of air, N_2, and CO_2 as a function of pressure by the ultrasonic method. J. C. HUBBARD and A. H. HODGE (J. Chem. Physics, 1937, **5**, 978—979).—Cf. A., 1937, I, 505. γ for air is 1·406 at 1 atm. and 1·580 at 100 atm., and for N_2 is 1·403 and 1·544 for these pressures. γ for CO_2 is 1·304 at 1 atm. and 3·524 at 60 atm. W. R. A.

Heat capacity of supercooled liquid glycerol. A. G. OBLAD and R. F. NEWTON (J. Amer. Chem. Soc., 1937, **59**, 2495—2499).—Data obtained by the method of mixtures, ensuring time for the complete establishment of thermal equilibrium, disagree with those obtained by the Nernst method for temp. <190° K., but appear to agree with a prolongation of the curve obtained by the Nernst method above 190° K. The long times required for equilibrium to be attained indicate that conclusions relating to the applicability of the third law of thermodynamics to glasses cannot be based on measurements by the Nernst method. E. S. H.

Free rotation about carbon–carbon linkings. L. S. KASSEL (J. Amer. Chem. Soc., 1937, **59**, 2745—2746).—Discrepancies in the vals of entropy for *n*- and *iso*-C_4H_{10} derived by different methods are discussed. E. S. H.

Entropy of isoprene from heat capacity measurements. N. BEKKEDAHL and L. A. WOOD (J. Res. Nat. Bur. Stand., 1937, **19**, 551—558).—The heat capacity of cryst. and liquid isoprene shows normal variation with temp. over the temp. range 20—300° K., its val. for the liquid at 298·2° K. being 152·6 joules per g.-mol. per degree. The latent heat of fusion is 4830±15 joules per g.-mol. The entropy at 298·2° K. is calc. as 229·3±1·0 joules per g.-mol. per degree. J. W. S.

Molecular heats and transformations of condensed hydrides and deuterides of sulphur and selenium. A KRUIS and K. CLUSIUS (Z. physikal. Chem., 1937, **B**, **38**, 156—176).—D_2S, prepared by deuterolysis of Al_2S_3, has m.p. 187·1$_4$° K. and mol. heat of fusion (L) 565·$_3$ g.-cal. It has transition points at 107·8$_2$° and 187·1$_4$° K., and its mol. heat (C_p) at 92—202° K. is recorded. H_2Se has m.p. 207·4$_3$° K. and L 601·$_1$ g.-cal. It has a transition point at 172·5$_4$° and a transition region at about 82·$_3$° K., and C_p at 61—230° K. is recorded. D_2Se, prepared by deuterolysis of Al_2Se_3, has m.p. 206·2$_4$° K. and L 595·$_7$ g.-cal. It has a transition point at 176·0$_2$° and a transition region at 90·0—91·0° K., and C_p at 64—233° K. is recorded. The deuterides differ from the corresponding hydrides in having higher C_p, transition temp., and heats of transition, and lower m.p. and L. The lower transition point of D_2S and H_2S corresponds with a phase transformation of the first order, whereas the transition region of the selenides corresponds with a transformation of a higher order. R. C.

Krypton. E. MATHIAS, C. A. CROMMELIN, and J. J. MEIHUIZEN (Ann. Physique, 1937, [xi], **8**, 467—

483).—A detailed account of investigations previously reported (cf. A., 1937, I, 231). Expressions are derived for l, and for the internal and external heats of vaporisation. An equation of the third degree in T gives the real as opposed to the rectilinear diameter, and leads to the val. $d_c = 0{\cdot}9191$ compared with 0·9085 from the rectilineal diameter. N. M. B.

Fusion point, vapour pressure, and heat of evaporation of vanadium oxytrichloride. H. FLOOD, J. GØRRISSEN, and R. VEIMO (J. Amer. Chem. Soc., 1937, **59**, 2494—2495).—$VOCl_3$ has m.p. −79·5°. The v.p. has been determined for the ranges 20—60° and −15° to 15°. The calc. average heat of evaporation (−15° to 130°) is 8·7±0·2 kg.-cal. E. S. H.

Atomic heat, entropy, and heats of fusion and vaporisation of xenon. Simple apparatus for liquefying ethylene. K. CLUSIUS and L. RICCOBONI (Z. physikal. Chem., 1937, **B**, **38**, 81—95). —The following data are recorded: m.p. 161·3° K.; mol. heat of fusion, 548·5 g.-cal.; characteristic temp. of Debye function for at. heat at 10—15° K., 55°; mol. heat of vaporisation at b.p. ($165{\cdot}1_3$° K.), 3020± 3 g.-cal.; caloric entropy at b.p., 37·66±0·10; statistical entropy at b.p., 37·58; v.-p. const., $1{\cdot}59_8 \pm 0{\cdot}02_2$; chemical const., $1{\cdot}58_8$. The at. heat has been measured between 10° K. and the b.p. The triple point pressure is not quite definite, probably because the element is a mixture of isotopes. An apparatus for liquefying C_2H_4 by cooling under pressure with a mixture of MeOH and solid CO_2 is described. R. C.

Establishment of temperature scale below 1° K. V. JACNYA (Bull. Acad. Polonaise, 1937, **A**, 260—268). —Theoretical. F. J. L.

Experiments on iron ammonium alum in alternating fields at very low temperatures. A. H. COOKE and R. A. HULL (Proc. Roy. Soc., 1937, **A**, **162**, 404—413).—The irreversible heating of Fe NH_4 alum by an alternating magnetic field between 0·035° and 0·11° K. has been measured. The heating effect ∝ the square of the field amplitude and the square of the frequency. It is ascribed to the existence of a time lag of about 10^{-8} sec. between applied magnetic field and induced magnetisation. The conditions under which this heating may be eliminated in calorimetric experiments with a.c. methods of temp. measurement are discussed. G. D. P.

Joule–Thomson effect and quantum statistics. D. S. KOTHARI and B. N. SRIVASAVA (Nature, 1937, **140**, 970—971).—Calculations show that for a degenerate gas the Joule–Thomson expansion produces a heating effect. During an adiabatic process a degenerate gas remains degenerate, and a non-degenerate gas will remain non-degenerate. Under suitable conditions, the Joule–Thomson effect may provide an experimental test of the statistics obeyed by gases, *e.g.*, He. L. S. T.

Dilatometric researches on the tempering and annealing of boric oxide glass. E. RENCKER (Compt. rend., 1937, **205**, 980—981).—Between 207° and 260° the change of vol. of B_2O_3 glass does not immediately follow change of temp. The hysteresis observed with rising or falling temp. is more pronounced the lower is the temp. E. S. H.

Abnormal dependence of the properties of water on temperature and pressure. G. TAMMANN (Z. anorg. Chem., 1937, **235**, 49—61).—The abnormal behaviour of H_2O can be interpreted on the hypothesis that at temp. up to approx. 60° it contains the large mol. ("H_2O I") which crystallises as ice I. The abnormal dependence of the sp. vol. on temp. and pressure for both H_2O and D_2O can be explained in this way. If the properties of H_2O below 60° depend on the concn. of H_2O I in accordance with the mixture law, then for various properties $\Delta_t/\Delta_{t=0}$ should be const., where Δ_t is the difference between the observed val. of a property and that obtained by extrapolation from higher temp. This is approx. true for v, c, n, and η (which are linear functions of temp. above 60° but not below), and also for [H·]. Furthermore, many sparingly sol. gases, liquids, and solids have a min. of solubility at temp. between 0° and 100°. For these, the corresponding relation $\Delta l_t/\Delta l_{t=0} = \text{const.}$ (where Δl_t is the difference between extrapolated and observed solubility) is approx. true. F. J. G.

Crystal structure of aliphatic compounds. III. Relations between true density and other properties of *n*-paraffin hydrocarbons. R. KOBAYASI (J. Soc. Chem. Ind. Japan, 1937, **40**, 341—345B). —The following empirical equations are fairly accurate for n-hydrocarbons CH_4—$C_{50}H_{102}$: $S = (3{\cdot}324 + 23{\cdot}114n)/(30{\cdot}76 + 13{\cdot}82n)$; $S/S' = 0{\cdot}2725 + 1{\cdot}105S$; $F = 587{\cdot}5S - 853{\cdot}2 = 497{\cdot}9S/S' - 931{\cdot}9$; $\log(\log B) = 0{\cdot}1329S + 0{\cdot}2393$; $O = 1{\cdot}184V/D^3 - 97{\cdot}5 = 1{\cdot}131M/D^3 - 118{\cdot}7$, where S and S' are respectively the true d and d at the m.p., F is the m.p. in ° C., B is the b.p. in ° K., O is the octane no., n is the no. of C atoms in the mol., V and D are respectively the vol. and main diameter of the mol. in A., and M is the mol. mass in g. × 10^{-24}. C. R. H.

Vapour pressure of phosphorus between 0° and 20°. K. FISCHBECK and H. EICH (Z. anorg. Chem., 1937, **235**, 83—88).—The v.p. of P has been measured at 0°, 10°, and 20° by the streaming method, the concn. of P vapour being determined iodometrically. The vals. are, in mm.: 20°, 0·0269; 10°, 0·0085; 0°, 0·0027. The heat of sublimation is 18·1 kg.-cal. per g.-mol. (P_4). F. J. G.

Vapour pressure of zinc chloride, lead chloride, and cadmium chloride in atmospheres of chlorine or nitrogen. D. N. TARASENKOV and G. V. SKULKOVA (J. Gen. Chem. Russ., 1937, **7**, 1721—1728).—The v.p. of $ZnCl_2$ in Cl_2 is < in N_2 at temp. < 700°, and > in N_2 at > 700°, that of $CdCl_2$ in Cl_2 is the same as in N_2 at < 850°, and < in N_2 at > 850°, and that of $PbCl_2$ in Cl_2 < in N_2 at 693—976°. R. T.

Influence of intensive desiccation on the vapour pressure of benzene. D. A. LACOSS and A. W. C. MENZIES (J. Amer. Chem. Soc., 1937, **59**, 2676—2682).—The v.p. of C_6H_6 at 80° is lowered markedly by drying with P_2O_5 at room temp., but raised slightly if drying has been at 90° or 105°. On access of ordinary air, or on heating the liquid in the sealed apparatus out of contact with P_2O_5, the v.p. reverts to the nor-

mal val. No change of v.p. occurs if the substances used are not pure and free from dust, or if BaO or $Mg(ClO_4)_2$ is used as desiccant. No change in the v.p. of CCl_4, *n*-heptane, or *cyclo*hexane is observed under conditions which cause a change in the v.p. of C_6H_6. E. S. H.

Simplified general equation of state. G. WOOLSEY (J. Amer. Chem. Soc., 1937, **59**, 2743—2744).—For the particular val. of the crit. coeff., $n_0 = 3{\cdot}25$, to which all data may be converted by means of the stretch formula, the vol. coeff., B, may be set equal to zero. The new form then becomes $[P + A/(T^{1/2}V^2 + CTV + DT^2)]V = 3{\cdot}25T + KP + q \log [(P/T) + 1]$. The determination of the consts. is simplified. E. S. H.

First partial derivatives of thermodynamic functions. F. LERMAN (J. Chem. Physics, 1937, **5**, 994).—Corrections (cf. A., 1937, I, 607). W. R. A.

Second virial coefficient of the different modifications of light and heavy hydrogen. II. Theoretical calculation. K. SCHÄFER (Z. physikal. Chem., 1937, **B**, **38**, 187—208).—A theoretical interpretation of the results previously published (A., 1937, I, 453) is offered. Using the methods of the statistical theory of gases and applying Schrödinger's equation for the collision of two gas mols. and the theory of perturbations an expression for the second virial coeff. is derived. This agrees with the data previously obtained and shows that the differences between the second virial coeffs. of normal and *p*-H_2 and those of normal and *p*-D_2, respectively, are negligible. For the representation of the second virial coeffs. of D and H over a wide temp. range exponential functions are necessary. R. C.

Polymerisation of gases and equations of state. L. HERMAN (Compt. rend., 1937, **205**, 1065—1067).—Variations of the vals. of a and b in van der Waals' equation at high pressures and low temp. are attributed partly to polymerisation, which tends to increase as the pressure increases; a and b decrease as pressure increases. J. A. D.

Distinction between physical coefficients in the perfect gas law. Graphical representation of coefficients and correct expressions for their numerical values. P. MILIANITCH (Bull. Soc. Chim. Yougoslav., 1937, **8**, 47—61).—Attention is directed to the necessity for distinguishing between the different vals. assumed by the gas const. according to the particular mass of gas considered. Similar distinctions are to be made between the Avogadro no. and related quantities. F. L. U.

Mechanical characteristics of halogenoanhydride molecules. G. P. LUTSCHINSKI (J. Gen. Chem. Russ., 1937, **7**, 2116—2127).—The η, sp. vol., and crit. vol. of a series of chlorides and oxychlorides of metalloids have been derived, and certain regularities are pointed out. R. T.

Theory of liquid structure. J. HIRSCHFELDER, D. STEVENSON, and H. EYRING (J. Chem. Physics, 1937, **5**, 896—912).—Mathematical. The equation of state previously obtained (A., 1937, I, 224) is extended and the process of fusion, viscous flow, and binary liquid systems are treated. W. R. A.

Influence of magnetic fields on the viscosity of gases. H. SENFTLEBEN and H. GLADISCH (Ann. Physik, 1937, [v], **30**, 713—727).—The influence of magnetic fields (1000—6000 gauss) on the viscosity of O_2 and NO has been investigated. The effect increases with field strength to a saturation val., and is a function of the ratio, H/p, of field strength and gas pressure, as was previously observed (Senftleben and Pietzner, A., 1933, 559) for the effect of magnetic field on the thermal conductivity of gases. At low pressures (<100 mm.), the effect decreases with decreasing pressure. The ratio of viscosity and conductivity effects is const. over a wide range of vals. of H/p. A differential method for the measurement of very small changes in viscosity is described. O. D. S.

Radiation stress of transverse waves and viscosity of liquids. R. LUCAS (Compt. rend., 1937, **205**, 1044—1047).—The components of the stress tensor in liquid waves have been deduced following the method of Brillouin in electromagnetism. The equation of state for fluids proposed by Debye and Ratnowsky is modified by an additional term to represent this stress. J. A. D.

Measurements of thermal diffusion in gas mixtures. G. BLÜH, O. BLÜH, and M. PUSCHNER (Phil. Mag., 1937, [vii], **24**, 1103—1114).—The measurement of thermal diffusion in gas mixtures by an interferometer method is described. From the measured total separations for the mixtures H_2–CO_2, H_2–N_2, He–A, and He–Ne, the Chapman theory indices of the mol. repulsive forces are calc. and show good agreement with vals. obtained by other methods. K. S.

Diffusion of pairs of gases with molecules of equal mass. L. E. BOARDMAN and N. E. WILD (Proc. Roy. Soc., 1937, **A**, **162**, 511—520).—The coeffs. of diffusion for the pairs N_2–CO and N_2O–CO_2 have been measured. Each pair consists of gases with similar physical properties so that a close approximation to self-diffusion is obtained. Measurement of the coeff. of diffusion for the pairs H_2–CO_2, H_2–N_2, and N_2–CO_2 gives vals. from which the coeffs. of self-diffusion of N_2 and CO_2 can be calc. Good agreement is obtained. G. D. P.

Theory of binary liquid mixtures. L. FRANK (Z. Elektrochem., 1937, **43**, 914—915; cf. A., 1937, I, 516).—A theoretical expression is derived for the heat of vaporisation which is in accord with experiment for $CHCl_3$–C_6H_6 mixtures. J. W. S.

Van Laar's theory of binary mixtures. P. DROSSBACH (Z. anorg. Chem., 1937, **234**, 298—306).—Attention is called to the importance of the work of van Laar in combining the van der Waals equation with thermodynamic relations (cf., *e.g.*, A., 1910, ii, 583). F. J. G.

Cohesive energy of liquid mixtures. II. A. J. STAVERMAN (Rec. trav. chim., 1937, **56**, 1189—1195; cf. A., 1937, I, 507).—A qual. explanation is offered of the relation between concn. and heat of mixing of two liquids one of which is polar. The theory

is discussed with special reference to the observations of Wolf (*ibid.*, 138) on mixtures of C_6H_{14} with aliphatic alcohols. F. L. U.

Intra- and inter-molecular linkages studied in the near infra-red. Chemical consequences. J. Errera (Helv. Chim. Acta, 1937, **20**, 1373—1387).—A lecture. F. L. U.

Dependence of density and viscosity in the system Na_2O–SiO_2 on temperature. (Inner structure of glazes.) G. Heidtkamp and K. Endell (Glastech. Ber., 1936, **14**, 89—102; Chem. Zentr., 1936, i, 4345—4346).—Measurements of d and η for Na_2O–SiO_2 melts containing 12—60% of Na_2O up to 1650° afford no evidence of the existence of compounds in the liquid phase. η and d vary continuously with composition. The formation of true glasses is limited to the range 23—33% Na_2O. J. S. A.

Thermal conductivity of ferrous alloys. N. N. Kurnakov and S. D. Rachmanovski (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 757—769).—The thermal conductivity, k, of Fe is considerably depressed by Si. Various grades of ferrochromium with 0·11—6·25% C have similar vals. of k. For ferromolybdenum k varies little with the origin or grade. R. C.

Magnetic properties of iron–rhodium alloys. M. Fallot (Compt. rend., 1937, **205**, 558—560; cf. A., 1937, I, 559).—Alloys with 0—60 at.-% Rh are discussed in relation to their α–γ and γ–α transformation temp., Curie points, and mean at. moments. The γ–α transformation temp. has a min. val. of 550° at 15—20 at.-% Rh. With <6·5 and >28 at.-% Rh the alloys are reversible in the neighbourhood of their Curie points; with 6·5—23 at.-% Rh they are irreversible and resemble the ferronickels. The mean at. moment increases linearly with [Rh] for 0—20 at.-%. A. J. E. W.

Influence of pressure on the Curie point of nickel–copper alloy. A. Michels, A. Jaspers, J. de Boer, and J. Strijland (Physica, 1937, **4**, 1007—1016).—From measurements of the resistance of Cu–Ni alloy (Ni 70%) at pressures between 0 and 2615 atm. in the neighbourhood of the Curie point, the latter is found to increase with increasing pressure at the rate of 6×10^{-5} degree per atm. The result is discussed with reference to recent theories of ferromagnetism. F. L. U.

X-Ray investigation of the cause of high coercivity in iron–nickel–aluminium alloys. A. J. Bradley and A. Taylor (Nature, 1937, **140**, 1012—1013).—X-Ray examination of slowly cooled Fe–Ni–Al alloys shows considerable divergences from Köster's diagram (A., 1933, 1238) and a revised diagram is given. When slowly cooled, these alloys break up into two body-centred cubic lattices of different composition, and so long as the structure remains coherent the Fe atoms are held apart in a condition of considerable strain which is the essential cause of high coercivity. L. S. T.

Microstructure and hardness of alloys consisting essentially of iron, chromium, and silicon. A. G. H. Andersen and E. R. Jette (Amer. Inst. Min. Met. Eng., Tech. Pub. 853, 1937, 8 pp.; Met. Tech., 1937, **4**, No. 7).—In the regions where the σ-phase ppts. from the α-phase the mode of occurrence of the σ-phase varies with the conditions and in turn influences the hardness of the alloy. Photomicrographs of some typical structures are shown. Hardness vals. for Fe–Cr–Si alloys with and without additions of C, Ni, or Mn are tabulated. In certain ranges the ternary alloys may be hardened by pptn. of the σ-phase from the α-phase. Age-hardening data are given. R. B. C.

X-Ray study of effects of adding carbon, nickel, or manganese to some ternary iron–chromium–silicon alloys. E. R. Jette and A. G. H. Anderson (Amer. Inst. Min. Met. Eng., Tech. Pub. 852, 1937, 15 pp.; Met. Tech., 1937, **4**, No. 7).—The influence of the added metals on the α-Fe phase and the boundary between this phase and the α + σ two-phase region has been examined. The solubility of C in the α-phase is about 0·02—0·04%. The influence of Ni (up to 2·0%) or Mn (up to 4·6%) on the solubility surface of the α-phase and on the lattice parameters of both α- and σ-phases is practically negligible. No tendency to form austenite could be detected by either X-ray diffraction or microscopic methods even at the highest concn. of C, Ni, or Mn. The results indicate that addition of Ni or Mn for improving individual properties may be made without changing other characteristics of the alloy. R. B. C.

Structure of bismuth–cadmium, tin–zinc, tin–cadmium, and aluminium–silicon eutectics. M. Straumanis and N. Brakšs (Z. physikal. Chem., 1937, **B**, **38**, 140—155; cf. A., 1936, 23).—In the first three the constituents form parallel monocryst. layers, or rods, which are associated to form eutectic fibres or laminæ. The tendency to form layers in the crystallisation of a eutectic is greatest with metals having crystals of a low degree of symmetry; in Al there are many equiv. directions and the tendency for unidirectional growth is relatively small. The development of layers is also determined by the atoms from the melt diffusing by the shortest path to the point of crystallisation. If the eutectic temp. is far below the m.p. of one component (*e.g.*, Si in the system Al–Si), that component separates in the form of minute unoriented crystals, distributed throughout the eutectic. R. C.

Physico-chemical analysis of the system lead–cadmium. B. G. Petrenko and E. E. Tscherkaschin (Ukrain. Chem. J., 1937, **12**, 385—396).—The fusion and conductivity diagrams do not suggest compound formation. The solubility of Cd in Pb is <2% at 50°, and between 3 and 6% at 200°. R. T.

Physico-chemical investigation of lead–bismuth alloys. N. S. Kurnakov and V. A. Ageeva (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 735—742; cf. A., 1937, I, 30).—The equilibrium diagram has been determined. The max. concn. of Pb in solid solution in Bi is 2%. A β-phase is formed by a peritectic reaction at 182° and in slowly cooled alloys exists over a concn. range of 65—70% Pb. It may be regarded as a solid solution of Bi in a hexagonal form

of Pb unstable in the pure state, or as a solid solution in some compound, probably Pb_3Bi. The max. concn. of the solid solution of Bi in Pb is 20% Bi. R. C.

Platinum–manganese alloys. V. A. NEMILOV, T. A. VIDUSSOVA, and M. N. PIVOVAROVA (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 743—752).—The f.p. curve is that of a system with complete miscibility in the solid state, and the liquidus and solidus curves have a min. The hardness–composition and temp. coeff. of the electrical resistance–composition curves show that at high temp. there is complete miscibility in the solid state, but at lower temp. the compounds $PtMn_4$, PtMn, and Pt_3Mn are formed. These form solid solutions with each other, and $PtMn_4$ forms solid solutions with Mn and Pt_3Mn with Pt. R. C.

X-Ray examination of platinum–ruthenium alloys. N. V. AGEEV and V. G. KUZNETZOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 753—755).—Solid Pt dissolves 70 at.-% or more of Ru to form a single solid phase. R. C.

Magnetochemical studies. XXVI. Magnetic investigation of the system chromium–sulphur. H. HARALDSEN and A. NEUBER (Z. anorg. Chem., 1937, **234**, 337—352).—The magnetic properties of Cr–S preps. having between 33·3 and 59·7 at.-% S have been studied. With 52·4 at.-% S χ is independent of H and varies only slightly with temp. From 53·5 to 57·1 at.-% S ferromagnetism occurs over a range of temp. having not only an upper but also a lower limit. In the paramagnetic region above the upper temp. the Curie–Weiss law is not obeyed. At the lower limiting temp. (−106° to −122°) χ falls very abruptly. No explanation of this abnormal behaviour can be advanced. At 57·1 at.-% S these abnormalities disappear, but specimens having 59·7 at.-% S become ferromagnetic at approx. −150°, and above this temp. they do not obey the Curie–Weiss law. The isotherms all have a sharp max. at 54—54·5 at.-% S, and at temp. above 20° there is a second max. at 50 at.-% S. These relations are compared with those shown by the Fe–S system. F. J. G.

Phase relationships in the system chromium–sulphur. H. HARALDSEN (Z. anorg. Chem., 1937, **234**, 372—390).—With a view of elucidating the magnetic relationships (cf. preceding abstract) the system Cr–S has been studied by means of X-rays. There are two homogeneous ranges (α- and β-phases) which extend from 50 to 54 and from 54 to 59·7 at.-% S, respectively. CrS has a hexagonal super-lattice containing 24 mols. (a 12·00, c 11·52 A.). With increasing [S] up to 54 at.-% this passes continuously into the simple NiAs structure with c/a 1·665—1·670. The β-phase is monoclinic up to 57·1 at.-% S, then passes continuously into a NiAs structure having c/a 1·625, and this extends up to 59·7 at.-% S. In the α-phase the mixed crystal formation involves both addition of S atoms to vacant spaces and subtraction of Cr atoms, but in the β-phase only the latter process. The ferromagnetism at 54 at.-% S is due to the presence of the max. no. of vacant spaces in the Cr lattice that is possible without a change of structure, and the prep. with 59·7 at.-% S, which is ferromagnetic at low temp., also has a NiAs structure with many vacant spaces in the Cr lattice. F. J. G.

Magnetochemical studies. XXVII. Magnetic and röntgenographic investigations in the system chromium–tellurium. H. HARALDSEN and A. NEUBER (Z. anorg. Chem., 1937, **234**, 353—371).—Cr–Te preps. with 50 to 58·3 at.-% Te are ferromagnetic below 20°, whilst with 60 at.-% ferromagnetism is found at lower temp. The dependence of χ on temp. is that of typical ferromagnetic substances and the Curie–Weiss law holds above the Curie point. This lies between 70° and 80° for <57·1 at.-% Te, and then falls to −80° at 60 at.-% Te. There are two homogeneous regions (α- and β-phases) extending from 50 to 54 and from 54 to 60 at.-% Te, respectively. The α-phase has the NiAs structure; the β-phase has a monoclinic structure up to 58·3 at.-% and then passes continuously into a NiAs structure. The max. of the χ-isotherms corresponds with the transition between the two phases. These relations are compared with those in the Cr–S system (cf. preceding abstract). F. J. G.

Application of the laws of displacement of equilibrium to heterogeneous liquid mixtures. P. M. MONVAL (Compt. rend., 1937, **205**, 1154—1156).—The changes of mutual solubility with temp. and pressure in the systems NH_2Ph–*cyclo*hexane, C_6H_{14}–$PhNO_2$, and NEt_3–H_2O are considered and compared with the systems KNO_3–H_2O and NH_4Cl–H_2O. A. J. E. W.

Concentrations, total and partial vapour pressures, surface tensions, and viscosities in the systems phenol–water and phenol–water–4% succinic acid. A. N. CAMPBELL and A. J. R. CAMPBELL (J. Amer. Chem. Soc., 1937, **59**, 2481—2488).—The temp.–composition and v.p.–composition diagrams have been determined. Comparison of the observed partial pressures with those calc. from Raoult's law indicates that PhOH accumulates at the free surface of the solution, where at a total [PhOH] of about 10%, it forms a practically continuous layer, which persists at all higher [PhOH]. This conclusion is confirmed by measurements of σ and η. Addition of succinic acid appears to have no effect on the establishment of the PhOH layer, but otherwise the PhOH appears to be more uniformly distributed in the body of solution; the deviation of observed from calc. partial pressures is even greater than with PhOH–H_2O. E. S. H.

Solubility of citric and tartaric acids in water. L. H. DALMAN (J. Amer. Chem. Soc., 1937, **59**, 2547—2549).—Data are recorded for 0—100°. The curve for citric acid consists of two straight lines intersecting at 35·8°; the solid phase above the transition temp. is anhyd. citric acid and that below 35·8° is the monohydrate. The curve for tartaric acid is a straight line, corresponding with the anhyd. acid. E. S. H.

Solubility of rotenone. II. Data for additional solvents. H. A. JONES and S. LOVE (J. Amer. Chem. Soc., 1937, **59**, 2694—2696; cf. A., 1930, 1043).—Data at 25° are recorded for 55 solvents, and at 0—65° for CCl_4. The calc. heat of dissolution of the

rotenone-CCl_4 solvate in CCl_4 is 8400 g.-cal. per mol. E. S. H.

Action of sodium glycocholate on fatty acids and soaps. I. Dissolving action of glycocholate.—See A., II, 46.

Kinetics of crystallisation. G. BIRSTEIN and M. BLUMENTUAL (Bull. Acad. Polonaise, 1937, **A**, 399—421).—The rate of crystallisation of $C_6H_2(NO_2)_3$·OH from H_2O and $CHCl_3$; fumaric acid from H_2O; p-$C_6H_4(OH)_2$ from glycerol and H_2O; $(CH_2·CO_2H)_2$ from H_2O, C_5H_{11}·OH, and paraldehyde at 25—50° has been measured. The rate of crystallisation const. k is derived from $dx/dt = k(a - x)^n$ where $n = 1, 2, 3$, or 4. F. J. L.

Diffusion of hydrogen through carbonyl iron at temperatures from 800° to 1100°. C. B. POST and W. R. HAM (J. Chem. Physics, 1937, **5**, 913—919).—The diffusion (D) of H_2 through H_2-purified carbonyl Fe shows breaks in the log D–$1/\theta$ curves at certain temp., which fall on a straight line and can be fitted to a Balmer type formula. W. R. A.

Adsorption isotherms and heats of absorption of oxygen and carbon monoxide on charcoal in the temperature range 90—50° K. A. VAN ITTERBEEK and W. VAN DINGENEN (Physica, 1937, **4**, 1169—1180; cf. A., 1937, I, 357, 510).—Adsorption isotherms determined for 5° temp. intervals, are found to agree with the Freundlich equation. The val. of $1/n$ decreases regularly with decreasing temp. in the case of O_2, but exhibits a max. near the transition point at 61·5 K. for CO. The heat of adsorption shows the usual hyperbolic relation to pressure for both gases. F. L. U.

Pressure of permanent gases at low temperatures in presence of silica gel. R. DELAPLACE (Compt. rend., 1937, **205**, 664—665; cf. A., 1937, I, 453).—Data for O_2, N_2, CO, and CH_4 at −182° to −134° are recorded, and a method of separating O_2 and N_2 from CO and CH_4 is suggested. A. J. E. W.

Simple formulæ relating to adsorption phenomena in mixtures. A. BOUTARIC (Compt. rend., 1937, **205**, 1149—1151).—Theoretical. Assuming Perrin's adsorption formula, equilibria between a solid adsorbent and two gaseous or liquid media are considered. A. J. E. W.

Dependence of exchange adsorption on dilution. E. N. GAPON and A. E. PRIANISCHNIKOVA (Kolloid. Shurn., 1937, **3**, 347—353).—Calculation shows that variation in the quantity of desorbed ions with change in vol. of a solution which contains a fixed amount of adsorbable ions is determined exclusively by the valency of the ions which are adsorbed or desorbed. Experiments with zeolites are described and the following systems are investigated: (1) XCa + NH_4Cl; (2) XCa + $BaCl_2$; (3) XH + $BaCl_2$. In (1), with increasing dilution the quantity of Ca desorbed falls, in (2) there is no change, whilst in (3) substitution of H by Ba increases. D. G.

Use of low-temperature van der Waals adsorption isotherms in determining the surface areas of various adsorbents. S. BRUNAUER and P. H. EMMETT (J. Amer. Chem. Soc., 1937, **59**, 2682—2689).—Adsorption isotherms for A and N_2 at −195·8°, A, N_2, CO, and O_2 at −183°, CO_2 at −78°, and n-butane and SO_2 at 0° have been determined for a variety of adsorbents. All the adsorbents except C give S-shaped isotherms. Consistent vals. for the surface area are afforded by the different isotherms for the same adsorbent. E. S. H.

Adsorption by van der Waals forces and surface structure. J. H. DE BOER and J. F. H. CUSTERS (Physica, 1937, **4**, 1017—1024; cf. A., 1935, 2).—Consideration of experimental data already published leads to the conclusion that for adsorption by purely non-polar van der Waals forces to occur a porous structure is necessary. F. L. U.

Adsorption theory of phenomena of dissolution. A. BASIŃSKI (Rocz. Chem., 1937, **17**, 567—577).—Theoretical. R. T.

Adsorption of ions of water by precipitates. I. I. TANANAEV and N. I. MIRIANASCHVILI (J. Appl. Chem. Russ., 1937, **10**, 1921—1930).—A new type of adsorption, termed hydrolytic adsorption, is presented in the pptn. of CaF_2 on mixing NaF and $CaCl_2$ in aq. solution, when the latter becomes acid, as a result of adsorption of OH′ by the ppt.; a method for the potentiometric titration of F′, based on pptn. of CaF_2 or SrF_2 in aq. EtOH, is described. R. T.

Intermolecular forces in two-dimensional systems. R. C. L. BOSWORTH and E. K. RIDEAL (Physica, 1937, **4**, 925—940; cf. A., 1937, I, 301, 511).—Surface spreading forces are discussed. Special importance is attached to the contact potential method in studying surface films. F. L. U.

Surface activity and structure of adsorption layers of multivalent soaps. L. R. SOLOVJEVA (Kolloid. Shurn., 1937, **3**, 303—308).—The surface activities and mol. consts. for Ca, Mg, and Al oleates and stearates have been determined. The surface activities of Ca and Mg soaps are approx. equal, but are 4—8 times that of Al soaps. Oleates are more active than stearates. Graphs and tables are given. D. G.

Blue sorbates of iodine on some acetates, benzoates, and hydroxides, especially potassium and rubidium acetates. A. KUTZELNIGG and W. WAGNER (Z. anorg. Chem., 1937, **234**, 150—154).—KOAc and $Sr(OH)_2$, when quite dry, are coloured brown by I, but in presence of traces of H_2O the colour is blue. KOAc, AcOH, and RbOAc behave similarly, but other acetates and the K salts of other fatty acids and of substituted fatty acids do not. In addition to a definite chemical structure of the anion, a definite ionic radius of the cation is necessary for the formation of a blue colour. F. J. G.

Contact potentials of multilayer films on metal plates. E. F. PORTER and J. WYMAN, jun. (J. AMER. Chem. Soc., 1937, **59**, 2746—2747).—Measurements of contact potential support the view that the X and Y films of multilayers of stearic acid on metal plates have different orientations (cf. A., 1937, I, 458). E. S. H.

Copper oxide films. H. A. MILEY (J. Amer. Chem. Soc., 1937, **59**, 2626—2629).—The thickness

of the films produced by heating Cu in the air is determined by measuring the no. of millicoulombs required for their cathodic reduction. The parabolic law $y^2 = kt + A$, connecting film thickness and tim of heating, is valid only for short periods; A is not zero for abraded surfaces. The film on heat-tinted Cu may contain CuO and Cu_2O, but under strongly oxidising conditions a sooty film (presumably CuO) obscures the later colours. E. S. H.

Flow of surface unimolecular layers. M. JOLY (J. Phys. Radium, 1937, [vii], **8**, 471—476).—Adaptation of the method of capillary discharge at surface layers shows that layers possess a resistance to discharge. This type of superficial viscosity of unimol. layers is characteristic of their nature and physical state. Unimol. layers of certain triglycerides have been investigated. W. R. A.

Measurement of speed of spreading of drops of aqueous solutions on mercury. R. S. BURDON, G. R. FULLER, and E. S. H. GIBSON (Trans. Faraday Soc., 1937, **33**, 1528—1531).—Photography with a cinema camera shows that for a given concn. the drop spreads with nearly uniform speed; the speed increases with increasing concn. and is accelerated slightly as the drop reaches about 3 cm. diameter. The results are discussed in relation to measurements of interfacial tension. E. S. H.

Spreading with uniform acceleration. W. D. ALLEN, K. GRANT, and R. S. BURDON (Trans. Faraday Soc., 1937, **33**, 1531—1532).—Heavy paraffins, after irradiation with ultra-violet light even in absence of air, spread on a H_2O surface. Initially the rate of increase of surface $\propto$ the area already covered, but after the diameter of the drop has reached 1 cm. an exact linear relation holds between the diameter and the square of the time. E. S. H.

Surface energy and flotation. S. G. MOKRUSCHIN (Kolloid. Shurn., 1937, **3**, 291—296).—The mechanism of flotation with particular reference to the manner of adhesion of the mineral particles to the air bubbles, with formation of foams, is discussed. It is considered that the "laminar theory," *i.e.*, film to film adhesion, is the most probable explanation of the process. D. G.

Relation between surface phenomena and dissociation constant of weak electrolytes in aqueous solutions. B. KAMIENSKI (Bull. Acad. Polonaise, 1937, **A**, 422—429).—The influence of $[H^+]$ on the dielectric potential and surface tension of solutions of org. acids, bases, and amphoteric electrolytes is discussed theoretically. Two types of isoelectric point are foreseen in amphoteric electrolytes and are typified by narceine and hydrocupreine. F. J. L.

Thermodynamical considerations on the dielectric potential and surface tension. B. KAMIENSKI (Bull. Acad. Polonaise, 1937, **A**, 430—440).—The p.d. at a H_2O-air interface is determined by the orientation of the H_2O dipoles; the no. of oriented H_2O dipoles decreases on addition of capillary-active substances and this produces a change in dielectric const. at the interface. The function connecting the p.d. and surface tension is complex and depends on the electrochemical behaviour and capillary activity of the solute. The p.d. at the H_2O-air interface is estimated at 600—1100 mv. by extrapolation. F. J. L.

Heats of wetting of cellulose by alcohols and their aqueous solutions. J. L. MORRISON, W. B. CAMPBELL, and O. MAASS (Canad. J. Res., 1937, **15**, B, 447—456).—The heat of wetting (H) of cellulose by MeOH, EtOH, $Pr^{\alpha}OH$, and $Pr^{\beta}OH$, and aq. solutions of the alcohols, has been determined at 25°. H is linear for 0—100% of MeOH, but for the other alcohols H is linear only for 0—80 mol.-% of alcohol, and at >80 mol.-% H decreases. H for pure MeOH is comparable with that for H_2O, but for the other alcohols is very much less, and decreases in the order of increasing mol. wts. The time of evolution of $0{\cdot}75H$, as calc. from the equation $H - H_t = \text{const.} \times \log t$ (t = time), is 1·5 × the val. for H_2O in the case of MeOH, but the remaining alcohols require much greater times for the evolution of $0{\cdot}75H$. Solutions of the alcohols higher than MeOH require rapidly increasing times for the evolution of $0{\cdot}75H$ at 75—80 mol.-% of alcohol. Desorption experiments were also made with cellulose containing 7—8% of H_2O which was immersed in pure alcohol, when a cooling effect was observed. It is inferred that H_2O is preferentially adsorbed by cellulose. R. S. B.

Capillary systems. XIX (5). Permeability of channelled and latticed capillary systems for gases. E. MANEGOLD (Kolloid-Z., 1937, **81**, 269—294; cf. A., 1938, I, 27).—Experimental data relating to the permeability of porous systems are discussed and recalc. when necessary in c.g.s. units. The sp. permeability (P) (= permeability × thickness × η of gas or liquid) is an important structural const. for the system considered. The systems reviewed include paper and membranes with a cellulose basis, wood, leather, SiO_2 gel, minerals, artificial stone and bricks, constructional and heat-insulating materials, powders, soils, silk fabric, and graphite. Measurements of P are made more easily and rapidly with gases than with liquids, and are better suited to characterise a given capillary system. P is independent of the nature and temp. of the fluid used, except when the channels in the material are very fine or when the substance itself is turgescible, in which case P (liquid) is < P (gas). F. L. U.

Metal membranes. Silver membranes. F. A. SANTALOV and R. E. NEUMAN (Kolloid. Shurn., 1937, **3**, 273—280).—Ag–Zn plates containing 74—77 wt.-% Ag were heated in vac. at 650—700° and the total vol. of the pores in the remaining Ag plate calc. (*a*) by comparing the d of the plate in H_2O before and after treatment, and (*b*) by subtracting from the vol. of the evaporated metal the shrinkage due to recrystallisation. The pore vol. is max. (about 23%) after heating for about 4 hr., when the evaporation of Zn is nearly complete and the recrystallisation of Ag still small. The radius of the pores measured by Bechhold's method is, *e.g.*, 7×10^{-6} cm. after 1½ hr. and $>10^{-4}$ cm. after 6 hr. of heating. All the membranes are permeable to methylene-blue. J. J. B.

Thermodynamic analysis of ultrafiltration. Ultrafiltration of sucrose and colloidal solutions.

L. B. FLEXNER (J. Biol. Chem., 1937, **121**, 615—630).—The free energy changes during ultrafiltration are said to be related to the partial molal vols. of the substances in the mother-liquor, the pressure during filtration, and the activities of the substances in the mother-liquor and filtrate. The theory is confirmed by data for aq. sucrose and casein and gum-arabic sols. The ultrafiltrate of a colloidal solution is equiv. in composition to a dialysate only when the filtration pressure is very low and the membrane sufficiently permeable. The equation derived can be used to decide whether the components of a body-fluid satisfy the requirements of an ultrafiltrate of blood-plasma. J. W. S.

Increase in the dipole moment of a diatomic molecule on dissolution in a non-polar liquid. F. FAIRBROTHER (Trans. Faraday Soc., 1937, **33**, 1507—1513).—The secular equation for a linking of mixed type is derived, and it is shown that the increase in dipole moment can be accounted for by the lowering of the energy levels of the ionic state relative to the covalent state by the solvation effect of the medium. E. S. H.

Partial molal volumes of potassium chloride, potassium bromide, and potassium sulphate in sodium chloride solutions. H. E. WIRTH (J. Amer. Chem. Soc., 1937, **59**, 2549—2554).—Data are recorded for solutions up to a vol. ionic strength of 1 at 25°. The partial mol. vols. of KCl and KBr depend only on the total vol. ionic strength of the solution; that of K_2SO_4 depends on the vol. ionic strength in dil. solutions, but in more conc. solutions of NaCl it is > the val. in H_2O. E. S. H.

Vapour pressures and partial molal volumes of aqueous solutions of the alkali sulphates at 25°. J. N. PEARCE and H. C. ECKSTROM (J. Amer. Chem. Soc., 1937, **59**, 2689—2691).—V.p. and d of aq. Li_2SO_4, Na_2SO_4, and K_2SO_4 have been determined and the activity of the solvent, mean activity coeffs., and partial and apparent mol. vols. of the solutes calc. E. S. H.

Measurement of turbidity in coloured media. F. W. ZERBAN and L. SATTLER (Science, 1937, **86**, 501).—A formula for the abs. turbidity of a coloured solution is given. L. S. T.

Viscosity of suspensions and solutions. F. EIRICH and R. SIMHA (Monatsh., 1937, **71**, 67—94).—A summary. J. W. S.

Electron microscope as an aid in colloid studies. D. BEISCHER and F. KRAUSE (Naturwiss., 1937, **25**, 825—829).—A review.

Electron microscope as an aid to colloid research. D. BEISCHER and F. KRAUSE (Angew. Chem., 1937, **50**, 933—934).—The more detailed structure of a system given by the greater resolving power of the electron microscope is illustrated by reference to a Au ruby glass, the formation of fibrous Fe and Ni by the decomp. of $Fe(CO)_5$ and $Ni(CO)_4$, and an electrolytically-prepared and etched Ag membrane. L. S. T.

Pure colloidal carbon. J. MILBAUER (J. Chim. phys., 1937, **34**, 691).—Colloidal C, prepared by the action of hot conc. H_2SO_4 on C_2H_2 and sucrose, has been examined with reference to the purity of the product. I. McA.

Preparation of a pure silver iodide sol. J. EECKHOUT (Natuurwetensch. Tijds., 1937, **19**, 237—242).—Small amounts of $Fe^{\cdots}$, $Pb^{\cdot\cdot}$, and $Zn^{\cdot\cdot}$ present in AgI sols are found to be derived from the H_2O used in the electrodialysis. H_2O which has been repeatedly distilled in SiO_2, Pyrex, or Jena glass apparatus contains these metallic impurities, which are entrained in the vapour. Zn may also be derived from the rubber connexions used in the apparatus. Purer AgI sols have been prepared by using a limited amount of H_2O and a longer time for electrodialysis. S. C.

Formation of colloids by hydrogen. C. ZENGHELIS and E. STATHIS (Compt. rend., 1937, **205**, 982—983).—Stable sols of Ag, Au, Pt, and Pd are obtained by reducing the appropriate aq. salts at 60° with Al and NaOH in presence of gum. E. S. H.

Influence of size of colloidal particles on their optical anisotropy. W. HELLER (Compt. rend., 1937, **205**, 971—973).—Measurements of the birefringence and dichroism of α-Fe_2O_3 sols show that there is a spectral displacement of these effects in the direction of longer λ as the size of the particles increases. E. S. H.

Effect of high-frequency electric field on colloids. I. J. SCHAFERSTEIN (Kolloid. Shurn., 1937, **3**, 181—186).—A high-frequency field (λ 3—12 m.) has no detectable influence on the viscosity, p_H, conductivity, surface tension, resistance to pptn., or protective power of blood-serum. R. C.

Influence of ultrasonic waves on colloidal phenomena. IV. Peptisation of mercuric sulphide. N. SATA and Y. NIWASE (Kolloid-Z., 1937, **81**, 294—300; cf. A., 1938, 1, 29).—The peptisability of pptd. and washed HgS is not affected by boiling with H_2O unless it is alternately boiled and washed (hot) by decantation. It then becomes stable towards H_2S, and after 40—50 days' treatment, stable also towards ultrasonic waves. The peptisability is attributed to minimal quantities of a third substance at present unidentified. F. L. U.

Nature of the inactivation of ions in solutions of lyophilic colloids. A. M. KOTSCHANOVSKI (Kolloid. Shurn., 1937, **3**, 321—326).—The pptn. of AgCl from solutions of $AgNO_3$ in gelatin, agar, and starch by solutions of NaCl is studied. A simple and visual qual. method for determining the inactivation of ions by lyophilic colloids is described. It is found that inactivation is due to the adsorption of ions by the micelles of lyophilic colloids. D. G.

High-frequency conductivity of colloidal electrolytes. III. Dispersion of the conductivity of caseinate solutions. G. SCHMID and T. R. AALTO (Z. Elektrochem., 1937, **43**, 907—914; cf. A., 1936, 1461, 1466).—The conductivities of alkaline and alkaline-earth caseinates have been measured at frequencies corresponding with 12, 20, 50, and 100 m. The results support the theory previously advanced. J. W. S.

Characteristic properties of acidic substances in colloidal solution as distinguished from

molecularly dispersed acids. J. N. MUKHERJEE, R. P. MITTRA, and S. MUKHERJEE (Kolloid-Beih., 1937, **47**, 1—90).—A review of previously published work (cf. A., 1933, 460, 1116; 1934, 729; 1935, 1202). F. L. U.

Dielectric measurements with hydrophilic colloids. III. Measurements with wave-length 0·857 m. H. R. KRUYT and J. T. G. OVERBEEK (Kolloid-Z., 1937, **81**, 257—269; cf. A., 1937, I, 615; 1938, I, 29).—Apparatus and procedure are described. The accuracy of the measurements is 0·1—0·2%. The lowering of ϵ by dissolved Na arabinate, Na-agar, sol. starch, ovalbumin, and gelatin is $\propto$ the concn. In the range 20—49° ϵ increases with rise of temp. except for starch and ovalbumin, which are not affected. Little or no change is produced by alteration of p_H (gelatin and ovalbumin), gelatinisation (gelatin, agar), addition of tannin, complex coacervation, or reduction of the ζ-potential by electrolytes. The general conclusion is that hydration does not give rise to a decrease of ϵ, but probably to a slight increase. F. L. U.

Coalescence of aërosols of water by chemically hygroscopic substances. V. I. SAITSCHUK and O. G. NARSKICH (Kolloid. Shurn., 1937, **3**, 231—245).—A mist of H_2O was found to be stable for 5 min., that of 1% NaCl solution for 22 min., and that of 50% $CaCl_2$ solution for 131 min. After introduction of a fine dust of NH_4NO_3, $NaNO_3$, $CaCl_2$, etc. the H_2O mist collapsed within 10 sec. J. J. B.

Emeraldin sols. III. Influence of the acidity of the solution when oxidising aniline on the dispersity, colour, and amount of oxidation products. V. PTSCHELIN (Kolloid. Shurn., 1937, **3**, 247—255; cf. A., 1936, 1068).—Oxidation of NH_2Ph by CrO_3 in aq. HCl gives a blue substance which gradually changes into emeraldin. J. J. B.

Isothermal and reversible immobilisation of the particles in thixotropic sols. W. HELLER and (MLLE.) G. QUIMFE (Compt. rend., 1937, **205**, 1152—1154).—Cessation of Brownian movement in thixotropic sols containing magnetic, anisotropic particles can be followed by observing the birefringence or dichroism produced in a magnetic field, the dichroism decreasing as solidification proceeds. A. J. E. W.

Properties of polymerides in solution. VII. Solubility of homologous series and homologous polymerides. VIII. Micelle formation in solutions of substances with chain-like molecules. IX. Gelatinisation. K. H. MEYER and A. VAN DER WYK (Helv. Chim. Acta, 1937, **20**, 1313—1320, 1321—1330, 1331—1334; cf. A., 1937, I, 413).—VII. The solubility of the higher paraffins in non-polar solvents can be represented by $N_2 = Ae^{-Bz}$, in which N_2 is the mol. fraction and z the no. of C atoms in the solute, and A and B are consts. related to the heat of fusion per C atom, the m.p., and the gas const. The expression, which, although not empirical, involves simplifying approximations, agrees satisfactorily with observation for $C_{34}H_{70}$ and $C_{60}H_{122}$ at different temp. The solubility of amorphous liquid polymerides is determined mainly by their mol. heat of dilution. Ostwald's "solid-phase rule" is a necessary consequence of the mol. heterogeneity of the substances to which it applies.

VIII. The chief cause of micelle formation between long chain mols. carrying a H_2O-sol. group is the cohesion of the solvent. By applying the law of mass action an expression is deduced from which can be calc. the distribution of wt.-concn. of micelles of varying complexity. Curves are drawn to show this distribution for different vals. of the association const. The osmotic effects (mean mol. wt., van 't Hoff factor) calc. from the curves are in agreement with those obtained cryoscopically.

IX. Temp.-reversible gelatinisation in solutions of soaps, starch, and gelatin is susceptible of a simple explanation in terms of a large % change in solubility over a small temp. range, which is characteristic of long-chain compounds. F. L. U.

Lyophilic colloids. XXVIII. Comparative study of solutons of amylose, amylophosphoric acid, and cellulose. P. KOETS and H. R. KRUYT (Kolloid-Beih., 1937, **47**, 100—132; cf. A., 1936, 1200).—Addition of aq. NaOH to a solution of amylose (I) first increases the η to a max. at 0·12N, beyond which η falls at a decreasing rate, becoming nearly const. at 1·2N. This behaviour is correlated with the ζ-potential of the particles, measured by the amount of hexol nitrate required to produce electrokinetic neutrality. From these and other observations it is inferred that in H_2O the dissociation of the OH groups of (I) is too slight to produce the ζ-potential required for stability. Addition of NaOH, by removing $H^{\cdot}$, results in increased dissociation and leads to a stable sol being formed between 0·12 and 0·13N-NaOH. Further increase of [NaOH] leads to attack of intramicellar OH groups and disruption of the micelles, whilst the smaller particles thus formed build up a double layer which gives rise to a high ζ-potential and to considerable hydration. Dehydration, leading to gelatinisation, is effected by addition of EtOH or by NaOH concns. >3·5N. Addition of HCl to (I) suppresses dissociation of the OH groups, but when the suppression is complete a residual electrokinetic activity persists, which is attributed to oriented H_2O dipoles. In amylophosphoric acid the degree of ionisation is sufficient to enable a stable sol to be formed in H_2O without the addition of NaOH. Cellulose, freshly regenerated from the xanthate, forms stable dispersions in aq. NaOH between 1·5 and 3·6N. It is shown by analysis that with increasing [NaOH] a gradual exchange of $Na^{\cdot}$ and $H^{\cdot}$ occurs until, at 3·5N-NaOH, the cellulose contains 3 combined Na atoms per glucose residue. This complete exchange is shown only by freshly regenerated cellulose. F. L. U.

Solubility and swelling of cellulose and of its derivatives. II. E. GUT and Z. ROGOVIN (Kolloid. Shurn., 1937, **3**, 327—335).—A general discussion of the solubility and swelling of cellulose and its derivatives when the solvent is (*a*) a pure liquid and (*b*) a mixture of different liquids. D. G.

Mechanism of deformation and fine structure of hydrocellulose. II. Mechanism of deformation, anisotropy of swelling, and mechanical properties of strongly swollen hydrocellulose

gels. P. H. HERMANS and A. J. DE LEEUW (Kolloid-Z., 1937, **81**, 300—326; cf. A., 1938, I, 29).—The prep. of isotropic threads of cellulose xanthate and of hydrocellulose is described. Such threads have been used in determinations of swelling anisotropy at various degrees of extension and in the examination of their elastic properties. The results are incompatible with the conception of independent rotatable particles imbedded in a viscous medium but are in substantial agreement with deductions from a theory which assumes a network of thread-like particles attached at their points of intersection. The micelles in a cellulose xanthate sol are partly cryst. and partly amorphous (bundles of parallel oriented mols. with frayed ends), a proportion of the latter becoming attached during gelatinisation. Extension of the coagulum results in an increasingly parallel alignment of the micelles, and brings into play fresh points of attachment, so that the degree of swelling decreases with increase of extension. The fraction of the total extension which is truly elastic decreases with increasing extension, reaching a min. at 60—70% extension. Measurements of the double refraction afford qual. confirmation of the deductions from the swelling experiments. F. L. U.

Deformation mechanism, swelling anisotropy, and fine structure of hydrous cellulose gels. P. H. HERMANS and A. J. DE LEEUW (Naturwiss., 1937, **25**, 794—795; cf. A., 1937, I, 515).—The work of Kratky (A., 1935, 286) is acknowledged. A. J. M.

Vapour pressure and bound water of starches. Z. P. TSCHESCHEVA (Kolloid. Shurn., 1937, **3**, 121—127).—The H_2O content–v.p. curves for potato, maize, and wheat starches have been determined, and the radii of the capillaries calc. Determination of the H_2O-binding power by Dumanski's method (A., 1934, 26) has shown that potato starch binds most H_2O and maize starch least. This method probably gives more trustworthy results than the v.-p. isotherms for the amount of bound H_2O, since in the isotherms it is difficult to distinguish between capillary condensation and sorption. R. C.

Effect of temperature on hydration of potato starch. T. A. GRANSKAJA and N. E. SAKUN (Kolloid. Shurn., 1937, **3**, 117—120).—The power of starch to bind H_2O, derived from the change produced in concn. of 0·25—1% aq. glucose solution, falls with rise of temp. from 0° to 50°, but with 5% glucose solution the influence of temp. is negligible. It seems that in the H_2O envelopes of the micelles the orientation of the dipoles is destroyed with rise of temp. and that this occurs the more readily the more remote these are from the micelle surface. R. C.

Evaluation of measurements of depolarisation of light scattered by protein solutions. E. WÖHLISCH (Biochem. Z., 1937, **294**, 145—152; cf. A., 1937, III, 412).—A formula is deduced enabling the depolarisation of light scattered by the dispersed material in a protein solution to be calc. from measurements of the total depolarisation at different concns. The results obtained by applying the method to data for fibrinogen solutions show an improvement on the uncorr. vals. F. L. U.

Heterogeneity of protein systems and homeomerism of their components. A. BONOT (Ann. Chim., 1937, [xi], **8**, 425—455).—A general discussion of the theory of homeomerism as developed by Urbain. Dilatometric data obtained at 22—60° with serum-albumin fractions cryst. from conc. solutions of $(NH_4)_2SO_4$ demonstrate the thermo-elastic homeomerism of the fractions. The limiting solubility of a mixture of the fractions is a linear function of the limiting solubilities of the components. C. R. H.

Physical chemistry of amino-acids, peptides, and related substances. X. Solubility of cystine in solutions of chlorides and sulphates. T. L. MCMEEKIN, E. J. COHN, and M. H. BLANCHARD (J. Amer. Chem. Soc., 1937, **59**, 2717—2723; cf. A., 1938, I, 30).—The solubility of cystine in H_2O and EtOH–H_2O in presence of salts has been determined at 25°. The solvent action of $CaCl_2$ is > that of NaCl; Na_2SO_4 and $(NH_4)_2SO_4$ have a solvent action in dil., but a pptg. action in conc., solution. Solvent action is approx. a function of the ionic strength; differences in solubility at the same ionic strength are ascribed to the salting-out effect. The vals. of the salting-out consts. for the above electrolytes have been determined. It is deduced that the dipole moment of cystine is $23—28·5 \times 10^{-18}$ e.u. Empirical equations have been developed for the interaction between ions and dipolar ions which describe the shape of the solubility curve at all concns. of the salts. E. S. H.

Properties of solutions of pectins. T. K. GAPONENKOV and V. N. KAZAKOV (J. Gen. Chem. Russ., 1937, **7**, 1878—1879).—Pectin sols are stabilised by sugars, citric acid, or glycine. R. T.

Influence of neutral salts on the optical rotation of gelatin. VI. Rotatory dispersion of gelatin in sodium chloride solutions. D. C. CARPENTER and F. E. LOVELACE (J. Amer. Chem. Soc., 1937, **59**, 2213—2216; cf. A., 1937, I, 134).—The [α] of solutions of gelatin in aq. NaCl at 0·5° and 40° for five λλ obeys a single-term Drude equation with a band at 2200 A. At 40° the const. of the Drude equation ∝ [NaCl], but at 0·5° the relation is logarithmic, attributed to a second form of gelatin. The consts. in presence of Na salts increase in the order NaCl < NaBr < NaI. F. R. G.

Complex coacervation of the system gelatin–saponin. R. RUYSSEN and E. VERSTRAETE (Bull. Acad. roy. Belg., 1937, [v], **23**, 739—748).—The vals. of η for mixtures of saponin and gelatin sols are almost additive at p_H >4·75 (the isoelectric point of gelatin), but at lower p_H considerable departures are observed, minima being reached at high saponin concns. (>90%). This is attributed to mutual electric saturation of the oppositely charged colloids. At p_H 2·60 no coacervation occurs; at p_H 3·04 it occurs only with mixtures containing 80—90% of saponin, but at p_H 3·9 and 4·15 pronounced and instantaneous coacervation is obtained over wide ranges of concn. The coacervates are dispersed on addition of NaCl, $COMe_2$, or EtOH. J. W. S.

Liesegang rings in gels. J. OBRIST (Kolloid-Z., 1937, **81**, 327—330).—A modification of the usual

method of producing Liesegang rings in gelatin plates is described. The gelatin containing one of the reactants is enclosed between two parallel glass plates, and is in contact with a relatively large vol. of the other reactant through a hole bored centrally in the upper plate. Drying of the gelatin is thus avoided and the concn. of the liquid reactant remains nearly const. F. L. U.

Influence of electrical contact with the soil on physicochemical reactions. F. Vlès and M. Gex (Arch. Phys. biol. Chim.-Phys. Corps organ., 1935, **12**, 74—137; Chem. Zentr., 1936, i, 4267).—The results of Philippson (A., 1912, ii, 914) are confirmed and extended to other systems. J. S. A.

Strength of strong mineral acids. H. von Halban and M. Seiler (Z. physikal. Chem., 1937, **181**, 70—78; cf. A., 1935, 1203).—Extinction coeff. measurements show that the relative effects of alkali perchlorates, nitrates, and chlorides on the dissociation const. of 2 : 4-dinitrophenol are independent of the cation, and that if the relative effects of the free acids (at concns. of 5×10^{-3} to 10^{-2}N) are equal to those of the salts the degree of dissociation of the acids is >99·9% (cf. A., 1936, 799). R. C.

Ionisation constant of lactic acid at 0—50° from conductance measurements. A. W. Martin and H. V. Tartar (J. Amer. Chem. Soc., 1937, **59**, 2672—2675).—Conductances of Na and K lactates and of lactic acid have been measured for a wide concn. range at 25° and at a single concn. from 0° to 50°; empirical equations for the conductance–concn. function have been derived. The ionisation const. has a max. val. of $1{\cdot}389 \times 10^{-4}$ at 22·5°. The ionisation const., and the changes in free energy, heat content, and entropy accompanying ionisation, are tabulated for the temp. range 0—50°. E. S. H.

Comparison of basicity of aliphatic amines in different solvents. C. Li and T. D. Stewart (J. Amer. Chem. Soc., 1937, **59**, 2596—2599).—A method for determining the relative strengths of org. bases in different solvents is described. Data are recorded for $NHEt_2$ and NEt_3 in EtOH, MeOH, PrOH, $Bu^{\gamma}OH$, dioxan, and CCl_4. Inversion of the relative base strengths occurs in some of the solvents. E. S. H.

Relation between equilibrium constants in water and in other solvents. Partition coefficients of ions. I. M. Kolthoff (Chem. Weekblad, 1937, **34**, 785—792).—Theoretical. The equilibrium const. in another solvent can be calc. from its val. in H_2O if the partition coeffs. of all the reactants are known. Expressions are derived for calculating the product of the partition coeffs. of two ions from distribution experiments and their quotient from e.m.f. measurements. Published data for the solubilities and partition coeffs. of electrolytes and the normal potentials of ions in different solvents are considered in the light of the expressions evolved. The variation of oxidation–reduction potentials and of the dissociation consts. of complex ions with the solvent is also considered. D. R. D.

Determination of the total hydration of the ions of strontium nitrate. F. Bourion and E. Rouyer (Compt. rend., 1937, **205**, 662—664; cf. A., 1937, I, 362, 411).—Cryoscopic data for solutions of resorcinol in 0·25M-$Sr(NO_3)_2$ suggest that the salt is associated with 21·4 mols. of H_2O; assuming no hydration of NO_3', this H_2O is associated with one $Sr^{\cdot\cdot}$ ion in agreement with the val. found for $Sr^{\cdot\cdot}$ in 0·25M-$SrCl_2$ solution. A. J. E. W.

Studies on the aqueous solutions of some chromic salts. I. Spectrochemical studies of the chloro-aquo-compounds. H. Sueda (Bull. Chem. Soc. Japan, 1937, **12**, 480—487).—Absorption spectra measurements have been made on solutions of Cr^{III} chloride and sulphate hydrates of various p_H. Solutions of violet Cr^{III} sulphate and of Cr alum contain respectively $[Cr(H_2O)_6]_2(SO_4)_3$ and $K[Cr(H_2O)_6](SO_4)_2$. The transformation of chloro-aquo-chromic salts into hydroxo-penta-aquo-chromic salts at $p_H > 4$ is confirmed. Shift of the absorption band towards increasing λ is caused by the substitution of Cl for H_2O. D. F. R.

Aqueous solutions of some per-salts obtained by action of hydrogen peroxide. (Mme.) M. E. Rumpf (Ann. Chim., 1937, [xi], **8**, 456—527).—Raman spectra, η, and ion transport data for solutions of $TiCl_4$ in dil. and conc. HCl show that H_2TiCl_6 exists in solution, and that on hydrolysis acids of the type $H_2[Ti(OH)_nCl_{6-n}]$ are formed. Absorption spectral data have been applied to the study of solutions of pertitanates, pervanadates, and perchromates. The formula $H_2[Ti(OH)_5{\cdot}O{\cdot}OH]$ is ascribed to the compound formed by interaction of 1 mol. of H_2O_2 with 1 mol. of $H_2Ti(OH)_6$. Its dissociation const. at 20° is $1{\cdot}12 \times 10^{-4}$. The colour change which occurs when solutions of $NaVO_3$ are acidified with dil. HCl is due to the formation of $VO_2{\cdot}Cl{\cdot}OH'$, for which $K_{20} = 4{\cdot}4 \times 10^{-3}$. With high [HCl] $VOCl_3$ is formed. 1 mol. of H_2O_2 reacts with 1 mol. of $VOCl_3$ to form VO_2Cl_3, for which $K_{20} = 2{\cdot}36 \times 10^{-4}$. Acid solutions of chromates and dichromates form, with H_2O_2, salts of H_2CrO_6 for which $K_{20} = 0{\cdot}43 \times 10^{-4}$. With neutral solutions of K_2CrO_4, $K_2CrO_4,(H_2O_2)_2$ is formed for which $K_{20} = 0{\cdot}185 \times 10^{-2}$. This is not a true per-salt but an additive compound. C. R. H.

Conditions governing the solubility of iron. L. H. N. Cooper (Proc. Roy. Soc., 1937, **B**, **124**, 299—307).—Max. activities of $Fe^{\cdot\cdot}$, $FeOH^{\cdot\cdot}$, and $Fe^{\cdot\cdot\cdot}$ which may exist in sea-H_2O have been calc. by use of existing data for the solubility products of Fe^{II} and Fe^{III} hydroxides and for the ion $FeOH^{\cdot\cdot}$. The activity of the $Fe^{\cdot\cdot\cdot}$ ion and the oxidation–reduction potential of the system control the max. activity of $Fe^{\cdot\cdot}$ ion. The max. activities of the three ions at equilibrium in sea-H_2O are tabulated. Other tables show equilibrium conditions over a range of oxidation–reduction potentials and [H·]. After equilibrium has been attained, the total quantity of Fe in true solution in H_2O does not exceed 3×10^{-8} mg. Fe per cu. m. at p_H 8·5, 4×10^{-7} at 8·0, 4×10^{-5} at 7·0, and 5×10^{-3} at p_H 6·0, and of this the greater part consists of $Fe^{\cdot\cdot}$ and $FeOH^{\cdot\cdot}$ ions. It may be necessary, in more acid solutions, to take ferrichloric acids into account. These vals. apply to Fe in sea-H_2O, in natural waters, and in many physiological fluids. F. B. P.

Dissociation pressures of sodium deuteride and sodium hydride. E. F. SOLLERS and J. L. CRENSHAW (J. Amer. Chem. Soc., 1937, **59**, 2724—2726).—Data are recorded for NaH at 310—380° and for NaD at 270—360°; the vals. for NaD are approx. twice those of NaH. Calc. heats of formation are: NaH 14,440, NaD 15,800 g.-cal. E. S. H.

Comparative study of dissociation pressures of sodium and potassium hydrides and deuterides. A. BOROCCO (Compt. rend., 1937, **205**, 983—985).—Employing a differential method of measurement at 260—350°, the dissociation pressures of NaD and KD are shown to be > those of NaH and KH, the difference increasing with rise of temp. E. S. H.

Affinity. LXXVII. Lower phosphides of manganese. Thermal analysis of the system Mn–MnP. F. WIECHMANN (Z. anorg. Chem., 1937, **234**, 130—141).—The only *subphosphides* are Mn_4P and Mn_2P, *d* 6·02. The compounds Mn_3P and Mn_5P_2 previously recorded do not exist. The equilibrium diagram up to 43 at.-% P is given, and the conclusions derived from it are confirmed by *X*-ray analysis. F. J. G.

Thermal analysis of the binary systems: aluminium iodide–iodides of other metals. A. T. NISHNIK (J. Gen. Chem. Russ., 1937, **7**, 1935—1947).—The fusion diagrams for the systems AlI_3–KI, $-HgI_2$, and $-SbI_3$, but not $-AsI_3$, $-SnI_4$, and $-I$, suggest formation of 1 : 1 compounds. Compound formation is associated with conducting power in the above systems. R. T.

Sodium dihydrogen orthoarsenate and its hydrates. P. GENET (Compt. rend., 1937, **205**, 732—734).—Data for solubility and *d* for the range from −20° to 120° are recorded. The solid phases recognised are: ice, $NaH_2AsO_4,2H_2O$, α- and β-NaH_2AsO_4,H_2O, $NaH_2AsO_4,0{\cdot}5H_2O$, and NaH_2AsO_4. E. S. H.

Investigation by physico-chemical analysis of reaction of stannic chloride and bromide with esters of dibasic acids and other organic substances. N. S. KURNAKOV and N. K. VOSKRESSENSKAJA (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 797—822; cf. A., 1937, I, 295).—M.p. and viscosity–composition curves indicate that compounds SnX_4,E are formed (E = ester of dibasic acid), in which Sn is bound to two non-hydroxylic O atoms. At a given temp. $SnCl_4$ is more reactive than $SnBr_4$. In systems with a given halide, replacement of the alkyl radical by a more complex one does not, in general, alter the character of the system. There is compound formation in the system $SnBr_4$–EtOH, but not in the system $SnBr_4$–PhOH. R. C.

Thermal analysis of binary mixtures containing esters of nitric acid. V. T. URBAŃSKI (Rocz. Chem., 1937, **17**, 585—590).—Mannitol hexanitrate (I) gives a 1 : 1 *compound*, transition point 55°, with *o*-$NO_2{\cdot}C_6H_4{\cdot}CHO$, and 1 : 2 *compounds*, transition points 46° and 48°, respectively, with *o*- and *m*-nitroanisole. Simple eutectic mixtures are formed in the systems (I)–*p*-$NO_2{\cdot}C_6H_4{\cdot}CO_2Me$ and erythritol tetranitrate–1 : 2 : 4 : 5-$C_6H_2Me(NO_2)_3$. R. T.

Graphical representation of the Boudouard equilibrium. W. J. MÜLLER and E. GRAF (Feuerungstech., 1937, **25**, 42—44).—Curves are given to show the equilibrium concn. of CO and CO_2 in presence of C at various temp. and pressures. R. B. C.

Activation of oxides by added oxides. II. Activation of copper oxide. R. SCHENCK and F. KURZEN (Z. anorg. Chem., 1937, **235**, 97—109).—The O_2 tensions and dissociation isotherms for mixtures of CuO with Cr_2O_3, Al_2O_3, Fe_2O_3 and Mn_2O_3 in the proportion $CuO : M_2O_3 = 3 : 1$ have been studied. In all cases the tension of O_2 is > for CuO alone, particularly in the case of Cr_2O_3. With Mn_2O_3 the curves indicate the existence of a no. of phases besides Cu_2O,Mn_2O_3, viz.: a *compound* $CuO,2(Cu_2O,Mn_2O_3)$ and two solution-phases which in equilibrium at 1000° have the approx. compositions $23(Cu_2O,Mn_2O_3)$ + 4CuO and $11(Cu_2O,Mn_2O_3)$ + 3CuO. F. J. G.

Polytherms of the ternary system HNO_3–HCl–H_2O and the binary systems HNO_3–H_2O, HCl–H_2O, and HCl–HNO_3. A. G. KOGAN and V. I. NIKOLAEV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 823—846; cf. A., 1937, I, 517).—For the system HCl–H_2O the cryohydric temp. is −70·5°. R. C.

Rare earth metals and their compounds. III. Ternary systems cerium group nitrates–nitric acid–water at 25° and 50°. L. L. QUILL and R. F. ROBEY (J. Amer. Chem. Soc., 1937, **59**, 2591—2595; cf. A., 1937, I, 517).—The order of decreasing solubility of the nitrates in aq. HNO_3 is Ce > Pr > La > Nd > Sm; the solubility of $La(NO_3)_3$ is anomalously low. The hexa-, tetra-, and tri-hydrated nitrates and the anhyd. salts exist as solid phases, crystallising from aq. HNO_3 solutions, but no evidence for the existence of a pentahydrate was found. In fractional crystallisation of the hexahydrates Ce and Pr should separate in the first fractions. E. S. H.

Stratification in ternary systems. I, II. V. F. UST-KATSCHKINTZEV (J. Gen. Chem. Russ., 1937, **7**, 2063—2068, 2069—2079).—I. Theoretical.

II. The phase diagrams for the systems H_2O–PhOH–AcOH (15°), $-CCl_3{\cdot}CO_2H$ (15°), $-H_2SO_4$ (15°, 100°, 180°), $-H_3PO_4$ (60—150°), and $-H_2C_2O_4$ (50—68°) are described. R. T.

Isomorphous salts as solid phase of saturated solutions of three salts of the same ion and of reciprocal salt pairs. E. JÄNECKE (Z. Elektrochem., 1937, **43**, 924—935).—The systems K_2SO_4–K_2CrO_4–K_2MnO_4–H_2O, KCl–NH_4Cl–RbCl–H_2O, and the reciprocal salt pairs $K^{\cdot}$–$Rb^{\cdot}$–Cl'–Br'–H_2O, $K^{\cdot}$–$NH_4^{\cdot}$–SO_4''–CrO_4''–H_2O, and $K^{\cdot}$–$NH_4^{\cdot}$–Cl'–SO_4''–H_2O have been studied at 25°. J. W. S.

Equilibrium studies on the reduction, oxidation, and carburisation processes of iron. XIV. System iron–oxygen–lime. R. SCHENCK, A. LAYMANN and E. JENCKEL (Z. anorg. Chem., 1937, **235**, 65—76).—Previous work (A., 1930, 43) on the system Fe–O–CaO has been extended and three new phases have been identified, viz., X, a saturated solution of CaO,Fe_3O_4 in FeO, approx. $2(CaO,Fe_3O_4)$ + 3FeO; Y, a saturated solution of $2CaO,Fe_2O_3$ in FeO, approx. $32{\cdot}5FeO + 4{\cdot}37(2CaO,Fe_2O_3)$; and Z, FeO satur-

ated with CaO, approx. 49FeO + CaO. These, with the phases already known, give rise at 900° to seven univariant systems which are tabulated. F. J. G.

Simultaneous solubility of aluminium, sodium, potassium, and ferric nitrates in aqueous nitric acid. I. A. I. ZASLAVSKI and I. L. ETTINGER [with E. A. EZEROVA] (J. Gen. Chem. Russ., 1937, **7**, 1948—1958).—Compound-formation is not observed in the system $Al(NO_3)_3$–$NaNO_3$–KNO_3–H_2O, at 0—60°. The solid phases are $Al(NO_3)_3,9H_2O$, KNO_3, and $NaNO_3$. R. T.

Third law of thermodynamics. F. SIMON (Physica, 1937, **4**, 1089—1096).—A general discussion. F. L. U.

Electrostatic activity coefficients in solvents of medium dielectric constant. P. GROSS, P. KUZMANY, and M. WALD (J. Amer. Chem. Soc., 1937, **59**, 2692—2694).—The influence of $AgNO_3$, $NaNO_3$, and $PhSO_3Na$ on the solubility of $AgBrO_3$ in $Pr^{\beta}OH$–H_2O of dielectric const. 25·6, and of LiCl on the solubility of $KBrO_3$ in EtOH (dielectric const. 25·78) has been investigated within the concn. range 10^{-3}—10^{-4}M. An approx. linear relation is observed between the logarithm of the activity coeff. and the sq. root of the ionic strength. Neither the individual properties of the ions (radius) nor the sp. properties of the solvent (except its dielectric const.) are of appreciable significance in relation to the val. of the activity coeff. E. S. H.

Integral free energies of dissolution of sodium chloride and potassium bromide. F. ISHIKAWA and K. MORIWAKI (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1244—1250).—The free energies have been calc. from published data. E. S. H.

Free energies of dissolution of zinc chloride and cadmium halides. F. ISHIKAWA and T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1251—1261).—Differential and integral free energies of dissolution and the differential free energy of dilution have been determined from e.m.f. data for reversible cells and from v.p. data for the aq. solutions. E. S. H.

Silver oxide: heat capacity from 13° to 300° K., entropy, heat of dissolution, and heat and free energy of formation. Heat of formation and entropy of silver ion. K. S. PITZER and W. V. SMITH (J. Amer. Chem. Soc., 1937, **59**, 2633—2639).—Data recorded for 25° are: entropy of Ag_2O 29·09 g.-cal. per degree per mol.; heat of dissolution of Ag_2O in dil. HNO_3 10,430±60 g.-cal.; calc. heat of dissolution of AgCl in H_2O −15,740 g.-cal.; entropy of $Ag^{\cdot}$ 17·54± 0·15 g.-cal. per degree; heat of formation of $Ag^{\cdot}$ 25,285±60 g.-cal. E. S. H.

Silver chlorite: its heat capacity from 15° to 300° K., free energy, and heat of dissolution and entropy. Entropy of chlorite ion. W. V. SMITH, K. S. PITZER, and W. M. LATIMER (J. Amer. Chem. Soc., 1937, **59**, 2640—2642).—Recorded data for 25° are: entropy of $AgClO_2$ 32·2 g.-cal. per degree per mol.; free energy and heat of dissolution of $AgClO_2$ in H_2O 4380±100 and 7200±100 g.-cal., respectively; entropy of ClO_2' 24·1 g.-cal. per degree. E. S. H.

Silver chromate: its heat capacity, entropy, and free energy of formation. Entropy and free energy of formation of chromate ion. W. V. SMITH, K. S. PITZER, and W. M. LATIMER (J. Amer. Chem. Soc., 1937, **59**, 2642—2644).—Heat capacities have been determined from 15° K. to 300° K. Data recorded for 25° are: entropy of Ag_2CrO_4 51·8 g.-cal. per degree per mol.; heat of dissolution of Ag_2CrO_4 in H_2O 14,450±160 g.-cal.; entropy of CrO_4'' 10·5± 1·0 g.-cal. per degree; free energy of formation of CrO_4'' Cr_2O_7'', and solid Ag_2CrO_4, respectively, −171,400, −305,800, and −150,800 g.-cal. E. S. H.

Heat of formation and specific heat of vanadium nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1262—1269).—The true sp. heat at 0—458·6° is given by $C = 0{\cdot}1351 + 2{\cdot}064 \times 10^{-4}t - 1{\cdot}057 \times 10^{-7}t^2$. The heat of formation of VN is +66,000 g.-cal. E. S. H.

Heat of combination of liquid bases with liquid acids to form liquid salts: piperidine and aliphatic acids. E. B. R. PRIDEAUX and R. N. COLEMAN (Trans. Faraday Soc., 1937, **33**, 1533—1540).—Data recorded are: C_3 9·5, C_4 9·45, C_5 9·4, C_6 9·15, C_7 9·1, C_8 9·75 kg.-cal. per g.-mol. The heat of formation of piperidine propionate in 10% C_6H_6 solution is 9·7 kg.-cal. per g.-mol. On adding excess of acid to the salt, considerable heat is evolved, whilst addition of excess of base produces a small heat effect; this phenomenon is probably due to partial reversal of mol. dissociation. E. S. H.

Heats of formation of simple organic molecules. F. D. ROSSINI (Ind. Eng. Chem., 1937, **29**, 1424—1430).—Heats of formation (H) are reviewed. For *n*-paraffin and olefine hydrocarbons and *n*-alcohols $>C_5$ there is a linear relation between H and the no. of C atoms, but for more complex mols. the effect of neighbouring atoms, the energy state of the C atoms, and the zero-point energy must be taken into account. I. C. R.

Thermochemistry of oxygenated hydrocarbons. M. BRUTZCUS (Compt. rend., 1937, **205**, 660—662; cf. A., 1937, I, 413).—The energy relations for partial and complete combustion of certain hydrocarbons and org. compounds containing O are discussed. A. J. E. W.

Electrical conductivities of metallic complexes in dilute solution. A. B. DENSHAM (Trans. Faraday Soc., 1937, **33**, 1513—1521).—The prep. of $NEt_4[Co(NH_3)_2(NO_2)_4]$, $[Cr(C_5H_5N)_4F_2][Co(NH_3)_2(NO_2)_4]$, and $[Cr(C_5H_5N)_4F_2]$ *picrate* is described. The electrical conductivities of these and related salts have been determined in MeOH, EtOH, $COMe_2$, and H_2O as solvents. The relation between Λ_c and $\sqrt{C}$ is in good agreement with Onsager's equation. The effect of addition of H_2O agrees with that calc. from the changes of concn. and η. E. S. H.

Ion transport in the diaphragm during electrodialysis. I—III. S. OKA (J. Soc. Chem. Ind. Japan, 1937, **40**, 381B, 381B, 382B).—I. The transport nos. of the anion and cation in the negatively charged diaphragm are respectively < and > the vals. without

the diaphragm. With increase in c.d. the transport nos. in the diaphragm approach the vals. without the diaphragm.

II. If the concns. on each side of the diaphragm differ, the transport nos. depend solely on the concn. on the cathodic side of the diaphragm if the latter is negatively charged, and on the concn. on the anodic side if the diaphragm is positively charged. If the transporting ions in the diaphragm are in such a combination as to form a difficulty sol. compound, the effect of the diaphragm on the transport nos. in it is small. If, however, the combination of ions is such as to form a weak electrolyte, the transport no. of the anion is small and that of the cation large when the diaphragm is negatively charged, and vice versa.

III. Where three different and independent transporting ions are present, the ratio of the transport nos. of the ions of the same sign = the ratio of the products of the concn. and ionic mobilities of the two ions. If two of the ions are OH′ and H˙ and the third is either independent or forms a difficultly sol. compound with either of the other two, slight decreases occur in the mobilities of an acid or hydroxide in the diaphragm according to whether OH′ or H˙ respectively takes part in the transportation. If the third ion forms a weak electrolyte with OH′ or H˙, the decreases are greater. C. R. H.

Attempt to determine the electrode potential and Raman spectrum of fluorine. Entropy of fluorine. C. S. GARNER and D. M. YOST (J. Amer. Chem. Soc., 1937, **59**, 2738—2739).—E.m.f. measurements of the cells F_2 (*p* atm.), KF (in HF(l)), PbF_2(s) + Pb(s) yielded irregular results. No Raman spectrum of F could be detected. The entropy calc. from published work is 48·6 g.-cal. per degree at 25° and 1 atm. E. S. H.

Electromotive behaviour of palladium hydride. P. NYLÉN (Z. Elektrochem., 1937, **43**, 915—921; cf. A., 1934, 1177; 1937, I, 49).—When the H content of Pd-black is $\geq$ that corresponding with Pd_2H its electrode potential against a buffer solution assumes a const. reproducible val. which changes regularly with the H˙ activity of the solution. The electrode may lose most of its H without change in this potential. It is inferred that the electrode potential is determined by the dissociation pressure of Pd_2H. Its val., measured against the reversible H_2 electrode, is +0·0690, 0·0596, and 0·0522 v. at 0°, 20°, and 35°, respectively. C.d.-electrode potential curves show that the electrode behaves like a metal electrode in metal salt solution. J. W. S.

Diffusion potentials. V. V. ČUPR and K. MAREK (Publ. Fac. Sci. Univ. Masaryk, 1937, No. 240, 14 pp.).—Conditions are discussed under which the relation $r_1/r_x + r_x/r_2 + r_2/r_1 = D = 0$ holds, where $r_2/_1$ is the diffusion potential between solutions R_2 and R_1, etc. Experimental data confirm the conclusion that if the compositions of solutions R_1 and R_2 containing three electrolytes (HCl, NaCl, KCl, and $MgSO_4$ were used) are represented by points on a tridimensional diagram, solutions R_x, which satisfy the above equation, are represented by a plane. C. R. H.

The world of concealed electrochemical potentials. B. KAMIEŃSKI (Rocz. Chem., 1937, **17**, 497—528).—A lecture. R. T.

Electromotive forces between glass and molten salts. B. VON LENGYEL and A. SAMMT (Z. physikal. Chem., 1937, **181**, 55—69).—The p.d., *E*, between glass and solutions of alkali salts in molten $PbCl_2$ at 550° have been measured. For Na glass in contact with a melt containing $>10^{-4}$ mol. Na per 100 g. of $PbCl_2$, *E* responds to changes in [Na˙] in accordance with Nernst's equation. For K glass in contact with a KCl solution the variation of *E* with log [K˙] is linear but Nernst's equation is not valid, and *E* varies from one specimen of glass to another of the same composition. Li glasses may act as Li electrodes in dil. solutions. In a melt containing both K and Na in contact with Na glass only the Na is electromotively active; apparently Na ions diffuse into the melt from the glass. With Na glass in contact with Li ions, the latter are electromotively active; Li ions in the melt and Na ions in the glass seem to be exchanged by diffusion. It is inferred that *E* is determined by the alkali ion which has the higher mobility in the glass. R. C.

Principles of construction of ideal cells, and their application to standard cells, galvanic cells, and accumulators. E. LANGE and K. NAGEL (Z. physikal. Chem., 1937, **181**, 1—54).—The conditions for reversibility are that within each phase at least one ion must have a sufficiently high conductivity, the diffusion of neutral substances being prevented, and that at all phase-boundaries through which the current passes the passage of ions determining potential shall be practically unhindered and the passage of other ions shall be as far as possible prevented. The requirements for the approx. realisation of these conditions are examined. In standard cells, such as the Weston cell, the H and O overvoltages must be large enough to prevent evolution of H and O at small c.d. The applications of the above principles in technical galvanic cells and in the Pb and Ni accumulators are discussed. R. C.

Electrode polarisation. I. Accurate measurement of the potential of a polarised electrode. A. HICKLING (Trans. Faraday Soc., 1937, **33**, 1540—1546).—The potential of a working electrode is measured by the use of an electrical interrupter, free from moving parts, whereby the polarising current can be stopped for any desired period from 10^{-5} to 20×10^{-5} sec., with any desired frequency, the potential being measured by a special potentiometer which is left in permanent connexion with the electrode and designed to measure transient max. and min. voltages. Results accurate to 0·01 v. may be obtained free from resistance error. The method may be used for studying the rate of fall of potential of electrodes, the potentials of which decay rapidly. E. S. H.

Phenomena of overpotential. M. LEMARCHANDS and W. JUDA (Compt. rend., 1937, **205**, 730—732).—Overpotential is ascribed to the fact that under certain conditions ions are discharged at the electrode more quickly than they can be replaced from the solution. The effect caused by roughening

the surface of the electrode is due to the decrease of effective c.d. caused by the increase of surface. Metals giving low overpotentials have low m.p. and are not readily roughened superficially. E. S. H.

Overpotential of hydrogen at a mercury electrode in ordinary and heavy water. J. HEYROVSKÝ (Chem. Listy, 1937, **31**, 440—447).—The reaction $H + D_2O \rightarrow HD' + OD'$ takes place at a Hg cathode. Since $[D'][OD'] = 0{\cdot}185 \times 10^{-14}$ is $< [H'][OH']$ all processes taking place at the cathode and involving interaction with water take place at a more negative potential in D_2O than in H_2O; to such processes belong the above, or the electro-reduction of aq. alkaline H_2O_2. On the other hand, processes involving only H or D proceed at the same rate; thus reduction of O_2, hydrogenation of fumaric or maleic acid, and deposition of cations occur at the same potential in D_2O and H_2O. R. T.

Electrodeposition of zinc on a single crystal of zinc. P. F. MICHALEV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 789—795).—The potential at which Zn is deposited from aq. $ZnSO_4$ becomes less negative as deposition proceeds, probably owing to increase in the active surface, A, causing a fall in the effective c.d. at the cathode. The differences between the discharge potentials at various c.d. decrease as electrolysis proceeds; the greater is the c.d., the more rapidly does A increase. At the beginning of deposition the deposit consists of thin plates, but subsequently oriented crystals develop. With a c.d. below 3×10^{-4} amp. per sq. cm. the deposit reproduces at first the structure of the underlying electrode. R. C.

Electrolysis of molten salts. P. DROSSBACH (Z. Elektrochem., 1937, **43**, 891—907).—The variation of electrode polarisation with time has been studied during electrolysis of fused $PbCl_2$, $MgCl_2$–KCl mixtures, LiCl, NaCl, and mixtures of NaCl with other salts. The current yields and energy consumptions for both the anodic and cathodic processes are recorded. J. W. S.

Point action of electrolytic valve anodes. A. GÜNTHER-SCHULZE and H. BETZ (Z. Physik, 1937, **107**, 633—641).—The threshold c.d. for the commencement of forming at Ta anodes in various electrolytes varies according to the state of the Ta surface. Roughened surfaces require larger vals. than highly polished surfaces and such effects are explained by point action at the unpolished surface. The magnitude of the threshold c.d. and forming velocity are related to the strength of binding of electrons in the anions. L. G. G.

Normal acidity potentials of 2 : 4-diketothiazolidines. H. ERLENMEYER, A. KLEIBER, and A. EPPRECHT (Helv. Chim. Acta, 1937, **20**, 1446).—Acidity potentials and dissociation consts. have been determined for 5 : 5-dimethyl-, -diethyl-, and -diallyl-2 : 4-diketothiazolidine. F. L. U.

Velocity of chemical reactions. J. ZAWADZKI (Rocz. Chem., 1937, **17**, 529—556).—A lecture. R. T.

Thermal decomposition of gaseous hydrogen peroxide. L. W. ELDER, jun. (J. Amer. Chem. Soc., 1937, **59**, 2737).—A reply to criticism (cf. A., 1937, 1, 190). E. S. H.

Reaction velocities at low temperature in the "water-gas" equilibrium.—See B., 1938, 13.

Kinetics of bimolecular association reactions. Rates of reaction of sodium atoms with oxygen, nitric oxide, and other oxides. C. E. H. BAWN and A. G. EVANS (Trans. Faraday Soc., 1937, **33**, 1580—1593; cf. A., 1937, I, 141).—The reactions of Na with O_2, NO, SO_2, SO_3, and H_2S occur in accordance with the mechanism $Na + X \rightarrow NaX^*$ (k_1), $NaX^* \rightarrow Na + X$ (k_2), $NaX^* + N_2 \rightarrow NaX + N_2$ (k_3). The velocity coeff. k_1 and the ratio k_2/k_3 have been determined. At high pressures of N_2 the reactions are bimol., whilst at low pressures the rate is determined by a triple-body collision mechanism. A general theory of the reactions is given; it is concluded that k_1 for NO and O_2 is determined by a transition probability. E. S. H.

Reaction of sodium atoms with the oxides of nitrogen, nitromethane, ethyl nitrate, and amyl nitrite. C. E. H. BAWN and A. G. EVANS (Trans. Faraday Soc., 1937, **33**, 1571—1579).—The rates of reaction have been determined by the diffusion flame method of Hartel and Polanyi. The chemiluminescence observed with N_2O and NO_2, and the mechanism of reaction, are discussed (cf. A., 1937, 1, 141). E. S. H.

Critical investigation and development of the "diffusion method" for determining speeds of atomic reactions. W. HELLER [with S. KODAMA] (Trans. Faraday Soc., 1937, **33**, 1556—1570).—The "diffusion method" of Hartel and Polanyi has been modified so as to yield quant. results. If certain experimental conditions are fulfilled the reaction velocities obtained differ by little >100% from the abs. vals. for reactions of collision no. between 5×10 and 5×10^3. E. S. H.

Study of oxy-coal gas flame by band spectra. N. R. TAWDE and J. M. PATEL (Current Sci., 1937, **6**, 155—156).—Intensity measurements on the Swan bands have been made, using flames supplied with different proportions of O_2 and coal gas, and the flame temp. are calc., assuming thermal equilibrium in the initial vibrational energy states. The max. calc. temp. is obtained with coal gas : $O_2 = 3{\cdot}5$, which is not in accord with the variation of flame size; the calc. temp. are $\gg$ the true temp. Thermal equilibrium of vibrational energy thus probably does not occur. A. J. E. W.

Combination of nitrogen peroxide and nitric oxide in the absence of moisture. D. L. CHAPMAN and M. C. C. CHAPMAN (J.C.S., 1937, 1991—1992).—There appears to be no difference between the combining properties of the very dry and of the partly dried gases. C. R. H.

Calculation of temperatures and pressures of combustion in a closed vessel. G. RIBAUD (Compt. rend., 1937, **205**, 1139—1141).—An expression is derived giving the total quantity of heat (Q) necessary to raise the temp. of the reaction products to $\theta°$, and to dissociate the products to the observed degree; the expression involves the relevant

equilibrium consts., the heats of dissociation, and the sp. heats of the products. Knowing the heat of reaction, the final temp. reached is deduced from a Q/θ diagram; the final pressure is then calc. Vals. calc. for the oxidation of CO and H_2 by the stoicheiometric quantities of O_2 and air are given. A. J. E. W.

Slow combustion of acetylene. W. A. Bone and J. E. Carruthers (Proc. Roy. Soc., 1937, **A**, **162**, 502—511).—Mixtures in the range of composition $4C_2H_2 + O_2$ to $C_2H_2 + O_2$ between 265° and 272° at atm. pressure have been studied as regards pressure–time curves, reaction rates, and rates of formation of the products of combustion. The reaction velocity $\propto [C_2H_2]^2$ and is independent of $[O_2]$. Reaction products identified and measured were: $(CHO)_2$, CH_2O, HCO_2H, CO, CO_2, and H_2O. Traces of an unidentified oily phenolic substance were found. The evidence is consistent with the hydroxylation theory. A formula representing the successive stages of slow combustion is given. G. D. P.

Relative rates of decomposition of the potassium salts of *m*- and *p*-substituted dibenzhydroxamic acids.—See A. II., 14.

Autoxidation of unsaturated fatty acids. III.—See A., II, 41.

Effect of pressure on slow reactions in solution. A. J. Rutgers (Physica, 1937, **4**, 978—980).—The observed influence of pressure on reaction rates is explained quantitatively on the assumption that two mols. combine stably only in ternary collisions, so that the velocity is $\propto (v - b)^{-3}$. F. L. U.

Absorption of oxides of nitrogen by alkaline solutions, and the influence of the state of the liquid and gaseous phases. V. I. Atroschtschenko (Ukrain. Chem. J., 1937, **12**, 442—460).—The relative rates of absorption of NO and of NO–NO_2 mixtures by H_2O, aq. NaOH, and aq. $NaNO_3$ vary according to the rate of flow of the gas, the design of the absorber, and the composition of the gas mixture and the absorbent. For these reasons, absorption coeffs. are applicable only to strictly defined conditions. R. T.

Principle of primary recombination in relation to the velocity of thermal reactions in solution. R. G. W. Norrish (Trans. Faraday Soc., 1937, **33**, 1521—1528).—Examples of the operation of the principle in the photo-decomp. of aldehydes and ketones in solution are given. A great reduction of quantum yield occurs in passing from the gaseous phase to solution with reactions in which free radicals are formed, but little change occurs with reactions which produce finished mols. The results are generalised for thermal reactions and provide an explanation of the differentiation of reactions in solution as normal and abnormal. E. S. H.

Kinetics of the hydrolysis of carboxyphosphinic acid. P. Nylén (Z. anorg. Chem., 1937, **235**, 33—41).—The reaction $PO(OH)_2 \cdot CO_2H + H_2O \rightarrow H_2CO_3 + H_3PO_3$ has been studied at 20° in acid solutions at const. ionic strength. The reaction is unimol. at const. $[H^\cdot]$ and the results are interpreted in terms of a spontaneous and a $H^\cdot$-catalysed hydrolysis of the undissociated mol. At higher concn. the catalytic efficiency of $H^\cdot$ appears to decrease. F. J. G.

Bimolecular mechanism for the hydrolysis of *tert.*-alkyl halides: hydrolysis of *tert.*-butyl bromide in acetone. W. Taylor J.C.S., 1937, 1853—1857; cf. A., 1935, 452; 1937, I, 417).—The second-order velocity coeff. of the hydrolysis of Bu^tBr in $COMe_2$ remains almost const. in presence of 1 or 2 g. of H_2O per 100 c.c. of solution. In presence of 1, 2, 5, or 10 g. of H_2O per 100 c.c. of solution, the equilibrium concns., calc. on the assumption of second-order coeffs. for both reactions, are in accord with the observed vals. J. W. S.

Relative reactivities of the aliphatic iodides. Interaction of alkyl iodides with sodium guaiacoxide in ethyl-alcoholic solution. J. A. Mitchell (J.C.S., 1937, 1792—1795).—The reactions between Na guaiacoxide and eight *n*-alkyl iodides are each bimol. The variation of the velocity coeff. (k) with initial concn. indicates that the guaiacoxide reacts through its ion, the contribution of the undissociated mol. being negligible. The variation of k with temp. is in accord with the Arrhenius equation. The reactivities of the iodides decrease rapidly from MeI to Bu^nI, and then remain almost const. J. W. S.

Walden inversion: configurational effects in the solvolytic reactions of α-phenylethyl chloride. J. Steigman and L. P. Hammett (J. Amer. Chem. Soc., 1937, **59**, 2536—2542).—The reaction between CHPhMeCl (I) and AcOH at 50° is essentially of the first order; that between (I) and $NEt_4 \cdot OAc$ in $COMe_2$ at 50° is of the second order. The reactions produce *l*-phenylethyl acetate from *d*-(I), racemisation being greater in the first. It is deduced that the first-order solvolytic reactions of alkyl halides in H_2O, EtOH, and AcOH are probably multimol., involving several mols. of the solvent, and that the driving force is derived largely from the energy of solvation of the halide ion. E. S. H.

Rate and mechanism of hydrolysis and alcoholysis of *tert.*-butyl chloride. Application to the transition state theory of solvent effects. A. R. Olson and R. S. Halford (J. Amer. Chem. Soc., 1937, **59**, 2644—2647).—Bu^tCl undergoes both hydrolysis and alcoholysis in EtOH–H_2O; the rates are bimol. and the reaction does not involve the primary breaking of a strong linking. The rates $\propto$ the product of the fugacities of the reactants, as measured by their v.p.; the proportionality const. is independent of the solvent. In terms of transition state theory the rate of reaction must be determined by the fugacity of the transition state, not by its concn. E. S. H.

Gross constants of the dissolution process of solid polyoxymethylenes.—See A., II, 42.

Theory of assimilation. III—V.—See A., III, 83.

Comparison of salt hydrates detected by dissociation [curves] with those crystallising from solution. A. Benrath (Z. anorg. Chem., 1937, **235**, 42—48).—The curves of rate of dissociation against composition for a large no. of hydrated salts when kept at const. temp. over H_2SO_4 have been

plotted, and the hydrates so indicated compared with those which are known to be formed on crystallisation. As a rule only the stable hydrates are indicated by the curves. F. J. G.

Kinetics of the thermal dissociation of the alkaline-earth peroxides, CaO_2, SrO_2, BaO_2. A. BLUMENTHAL (J. Chim. phys., 1937, **34**, 627—640; cf. A., 1936, 944).—From volumetric, tensimetric, and gravimetric measurements, decomp.–time curves are determined at temp. in the range 240—740°. In the equilibrium $MO_2 \rightleftharpoons MO + O$, high temp. and low v.p. favour the endothermic dissociation. The solid solution MO_2–MO is confirmed optically. Rhythmic decomp. marked at the lower temp. is due to transient lowering of temp. and dissociation pressure, associated with readsorption of O. Activation energies are discussed. I. McA.

Kinetics of wetting and linear corrosion of metals in polyphase systems. IV. Metal–liquid–liquid and metal–liquid–gas. D. I. MIRLIS (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 273—280).—The selective linear corrosion of Fe along the three-phase boundary in the equilibrium systems Fe–aq. $R{\cdot}CO_2H$–C_6H_6 and Fe–aq. $R{\cdot}CO_2H$–air (R is saturated hydrocarbon chain) $\propto$ the surface energy of the solute. The corrosion of the Fe in the aq. phase decreases and in the C_6H_6 and vapour phase increases with increase in the length of R. F. J. L.

Reaction velocity in the system $solid_I$ + gas $\rightarrow$ $solid_{II}$. II. Flow systems. G. S. GARDNER (J. Math. Physics Mass. Inst. Tech., 1937, **16**, 77—84; cf. A., 1936, 166).—The velocity equation previously developed for closed systems has been applied to flow systems. The equation expressing the change of partial pressure of reactant gas (p) with time (t) at any point in a tube in which the reaction occurs is: $d[(ap_\infty)^{\frac{1}{2}} - (a[p_\infty - p])^{\frac{1}{2}}]/dt = Ap/([(ap_\infty)^{\frac{1}{2}} - (a[p_\infty - p])^{\frac{1}{2}}] + B)$, where a, A, and B are consts. Experimental data for the reaction between H_2S and Fe_2O_3 are in agreement with theory. E. S. H.

Explosivity of systems containing potassium permanganate or dichromate and combustible substances.—See B., 1938, 51.

Influence of hydrogen and deuterium on the thermal decomposition of diethyl ether in the low-pressure region. J. W. MITCHELL and C. N. HINSHELWOOD (Proc. Roy. Soc., 1937, **A**, **162**, 357—366).—At 525° D_2 is $<0{\cdot}1$ as efficient as H_2 in activating the chain-free decomp. At higher temp. a positive effect is ascribed to exchange reactions which give H_2. Experiments made without the addition of NO, which eliminates the influence of chains, show that D_2 has a considerable effect, although $<$ that of H_2. G. D. P.

Inhibition by nitric oxide of the decomposition of ethane. L. A. K. STAVELEY (Proc. Roy. Soc., 1937, **A**, **162**, 557—568).—The initial rate of thermal decomp. of C_2H_6 is reduced by the presence of NO to a well-defined limit. The effect is attributed to the ability of NO to suppress reaction chains by combining with free radicals or atoms. Vals. of the mean chain length vary between 6 and 21, according to temp. and pressure. As only a small proportion of activated C_2H_6 mols. yield radicals, the majority undergoing rearrangement to give C_2H_4 and H_2 directly, the abs. chain length must be high. The fact that the mean chain length diminishes as the C_2H_6 pressure increases suggests that H atoms are the chain carriers. G. D. P.

Ozone as oxidising catalyst. X. Analysis of very dilute ozone. V. Influence of solvent on sensitivity of reaction. E. BRINER and E. PERROTTET (Helv. Chim. Acta, 1937, **20**, 1523—1528; cf. A., 1937, I, 260).—In using the method previously described, PrCHO is more sensitive than PhCHO to small traces of O_3. The extent of oxidation depends to a marked degree on the solvent, standard *iso*octane giving by far the best results. A connexion between this effect and the antiknock properties of *iso*octane is suggested. F. L. U.

Kinetics of thermal decomposition of potassium formate in presence of alkali metals. L. C. FREIDLIN (J. Gen. Chem. Russ., 1937, **7**, 1675—1682).—The reaction $2HCO_2K \rightarrow K_2C_2O_4 + H_2$ is catalysed by K or K–Hg. The reaction is of the second order, and involves intermediate formation of $OH{\cdot}CH(OK){\cdot}CO_2K$. R. T.

Oxidation of manganous salts to permanganates. D. I. ERISTAVI (J. Gen. Chem. Russ., 1937, **7**, 1713—1720).—Oxidation of Mn^{II} to Mn^{VII} by S_2O_8'' or OBr′ is possible in presence of $AgNO_3$ or $CuSO_4$, respectively; in absence of these catalysts the reactions cannot be activated by *X*-rays or ultra-short waves. R. T.

Multimolecular solvolytic reactions: water catalysis in the alcoholysis of benzhydryl chloride. N. T. FARINACCI and L. P. HAMMETT (J. Amer. Chem. Soc., 1937, **59**, 2542—2546).—The composition of the product of solvolysis in EtOH containing small amounts of H_2O has been determined; the proportion of $CHPh_2{\cdot}OH$ is $\ll$ would follow from hydrolysis superimposed on alcoholysis. The linear increase in rate produced by H_2O is mainly catalytic. The effect of small amounts of H_2O, heptane, and $PhNO_2$ on the rate of solvolysis is not a function of dielectric const. of the medium. The rate of reaction is reduced nearly to zero when $CHPh_2Cl$ and H_2O or EtOH are present as solutes in low concn. in $COMe_2$. The results support the view that the solvolytic reactions are multimol. E. S. H.

Inhibition by thiol-compounds of autoxidation. J. C. GHOSH and P. C. RAKSHIT (Biochem. Z., 1937, **294**, 330—335; cf. A., 1937, III, 104).—The autoxidation of dissolved $NaHSO_3$ at p_H 7·0 and 20° is inhibited by low concns. of oxidised or reduced glutathione (I), cystine, cysteine (II), or thiolpropionic acid (III). Approx. equiv. amounts of Cu or Hg salts counteract the effect. Inhibition by (I) is not prevented by $CH_2I{\cdot}CO_2Na$. Reduced (I), (II), and (III) inhibit the autoxidation of quinol (H_2S also inhibits) at p_H 8·0 and 20°, of pyrogallol at p_H 7·7 and 20°, and of $CO(CH_2{\cdot}OH)_2$ at p_H 7·2 and 30°, but higher concns. of the inhibitors are required than with $NaHSO_3$. The amount of inhibitor required increases but slightly

when the substrate concn. is increased. For inhibition of the autoxidation of dissolved (II) approx. equimol. (I) concn. is required. The inhibitors act by forming complexes with active O, which is later liberated as mol. O_2. W. McC.

Acid–base catalysis in the depolymerisation of dimeric dihydroxyacetone. R. P. BELL and E. C. BAUGHAN (J.C.S., 1937, 1947—1953).—The reaction, which has been studied dilatometrically at 25°, is shown to be of the first order and to be subject to catalysis by acids and bases. Buffers prepared with $Bu^{\gamma}CO_2H$, AcOH, $CH_2Ph{\cdot}CO_2H$, $CH_2{:}CH{\cdot}CO_2H$, HCO_2H, $OH{\cdot}CHPh{\cdot}CO_2H$, $CH_2Cl{\cdot}CO_2H$, and $CN{\cdot}CH_2{\cdot}CO_2H$ were used, and the various catalytic consts. were calc. The catalytic const. of the undissociated acid, k_A, and of its anion, k_B, are connected with the dissociation const. of the acid, K, by the empirical relations $k_A = 0{\cdot}2K^{0{\cdot}38}$ and $k_B = 5 \times 10^{-5}K^{-0{\cdot}76}$. The catalytic consts. k_{H_2O} and $k_{OH'}$ are 1·72 and 4·03 × 10^7, respectively, the former val. agreeing with data obtained with HCl as catalyst. The " spontaneous " rate due to H_2O mols. is 0·00255, from which k_{H_2O} is 4·6 × 10^{-5}. The interpretation of k_{H_2O} is discussed, but it cannot be decided whether catalysis by H_2O mols. represents acid or basic catalysis or both. C. R. H.

Reaction mechanism of catalase and peroxidase in the light of the theory of chain reactions.—See A., III, 72.

Decomposition of hydrogen peroxide by carbon. V. SIHVONEN (Suomen Kem., 1937, **10**, B, 25—26).—The catalytic decomp. of H_2O_2 by laminar and microcryst. graphite and by sugar C is decreased in presence of 2N-H_2SO_4 and increased in presence of 2N-NaOH. The gas evolved contains some CO_2, especially at higher temp., and is < the vol. corresponding with the decrease in $[H_2O_2]$, indicating that some O_2 is adsorbed by the C. The temp. coeff. of the decomp. by graphite is > that for decomp. by sugar C. The catalytic effect is made irregular by the protective action of gas bubbles on the C. Adsorption isotherms for 1°, 20°, and 80° have been deduced. J. W. S.

***X*-Ray examination of copper–magnesium oxide catalysts.** G. G. JORIS, J. VERHULST, and H. S. TAYLOR (Bull. Soc. chim. Belg., 1937, **46**, 393—407; cf. A., 1937, I, 524).—The oxide mixtures CuO : 4MgO and CuO : 2MgO were prepared by five different methods, from oxides and by pptn. and co-pptn. of the hydroxides followed by ignition, and the catalyst formed by reduction in H_2 at 200°. The *X*-ray spectra ($K\alpha$ line) of the hydroxide, oxide, and catalyst mixtures were measured; they vary enormously with the mode of prep. For hydroxide and oxide mixtures (1 : 4) prepared by co-pptn. the spectra contain no lines corresponding with $Cu(OH)_2$ or CuO, respectively; in the corresponding catalyst the Cu is extremely finely divided. All other mixtures gave spectra containing characteristic lines of both Cu, CuO, or $Cu(OH)_2$ and MgO or $Mg(OH)_2$. K. S.

Catalytic properties of rhenium. VI. Decomposition of methyl alcohol over rhenium. M. S. PLATONOV, V. I. TOMILOV, and E. V. TUR (J. Gen. Chem. Russ., 1937, **7**, 1803—1804).—Re dehydrogenation catalysts cannot be used for the prep. of CH_2O from MeOH, as they also catalyse dehydrogenation of CH_2O. High yields of CH_2O are obtained at 400°, with high flow velocity, using Re catalysts poisoned with H_2S or As_2O_3. R. T.

Sorptional and catalytic properties of active manganese dioxide, with respect to substances in the gaseous or vapour phase. II. Influence of admixture of electrolytes on the catalytic activity of manganese dioxide. E. V. ALEXEEVSKI and A. S. SOSKIND (J. Gen. Chem. Russ., 1937, **7**, 1683—1686).—The activity of MnO_2 catalysts of oxidation of CO in damp air is abolished by addition of 0·05 g.-equiv. of alkali or alkaline-earth hydroxides, chlorides, nitrates, sulphates, or carbonates per g.-mol. of MnO_2. The anti-catalytic activity falls in the series Na > K > Li, and Ba > Sr > Ca, and $OH' > CO_3''$, $SO_4'' > Cl' > NO_3'$. R. T.

Thermal effect on the catalyst of the water-gas reaction. M. KUROKAWA and Y. TAKENAKA (J. Soc. Chem. Ind. Japan, 1937, **40**, 347B).—The resisting property of Fe_2O_3 catalyst is increased by addition of Cr_2O_3, and the further addition of MgO gives more refractoriness. A catalyst containing $Fe_2O_3 : Cr_2O_3 : MgO$ in the ratio 1 : 0·1 : 0·03 is the least sensitive to heat and most active in conversion. C. R. H.

Catalytic properties of cerium oxide. S. B. ANISIMOV (J. Gen. Chem. Russ., 1937, **7**, 1931—1934).—CeO_2 and Ce_2O_3 act as dehydrogenating catalysts of EtOH at 300—500°, the reactions being probably $2EtOH \rightarrow 2MeCHO \rightarrow EtOAc$; $2EtOAc \rightarrow COMe_2 + CO_2 + C_2H_4 + EtOH$. No hydrogenating activity was found with a C_2H_4–H_2 mixture at 450°. R. T.

Inhibition of corrosion by mixtures of passivators. A. V. SOLOVIEV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 771—788).—The corrosive action on cast Fe and steel of aq. NaCl containing passivators has been examined. Na_2CO_3, $K_2Cr_2O_7$, Na_2SiO_3, and $NaNO_2$ delay corrosion, whilst NaOAc accelerates it. The retarding action of Na_2CO_3 is much increased by the presence of $NaNO_2$. In presence of a mixture of Na_2SiO_3 and $NaNO_2$ a film is formed on the metal, which protects it from corrosion and progressively thickens. This mixture renders passive Fe, Cu, Ni, Zn, and Cd. The anodic and cathodic polarisations in a solution of 0·1N-$NaNO_2$ + 0·1N-Na_2SiO_3 of Fe in contact with Cd, Pb, Zn, Cu, and Ni have been measured. On making contact, the electrochemical potentials of the metals approach. R. C.

Catalytic action of ozone in the oxidation of aldehydes ; influence of the peracid. E. BRINER and E. PERROTTET (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 101—104; cf. A., 1937, I, 321).—The rate of absorption of O_2 on shaking with a solution of PhCHO in petroleum is considerably increased in presence of 1 in 10^7 of O_3. Presence of peracid in the PhCHO facilitates oxidation. A. J. E. W.

[Catalytic] oxidation of methane at high pressures.—See B., 1938, 35.

Optimum concentration of sulphur dioxide in the contact process of sulphuric acid production.—See B., 1938, 50.

Inactivation of ammonia catalysts by lubricating oils.—See B., 1938, 50.

Preparation and use of copper-nickel catalyst.—See B., 1938, 51.

Effect of oxygen and reduced nickel on the catalytic action of hydrogen bromide on the isomerisation of *iso*stilbene to stilbene.—See A., II, 48.

Influence of catalysts on oxidation of oils.—See B., 1938, 20.

Hydrogenation [of aromatic compounds] in presence of catalytic alloys at high pressures.—See B., 1938, 36.

Reaction mechanism at a graphite electrode. V. Sihvonen [with (Frl.) S. Wilska, (Frl.) U. Lehinen, U. Yltiä, and T. Aalto] (Suomen Kem., 1937, **10**, **B**, 27).—In the a.c. electrolysis of dil. H_2SO_4 between Pt plate electrodes traces of H_2O_2 are formed, the yield increasing with increasing c.d. and period of alternation to a max. of about 10% of the amount of H_2 and O_2 evolved. The latter is < theoretical for the current consumption. When O_2 is introduced through pores in a graphite cathode in dil. H_2SO_4 slight H_2O_2 formation occurs, and the yield reaches a limiting val. (*c*) in a few hr. (*c*) increases with increasing c.d. but is < the concn. obtained when O_2 is passed through a Pt mesh cathode. The stationary state is attributed to equilibrium between the reactions $2H + O_2 \rightarrow H_2O_2$ and $2H + H_2O_2 \rightarrow 2H_2O$. Electrolysis of acid, alkaline, or neutral solutions containing ClO_3' using graphite electrodes yields no ClO_4'. Similarly no S_2O_8'' is formed at a graphite anode in conc. H_2SO_4, the main anodic products being CO_2 and CO, admixed with O_2 only when dil. acid and a high c.d. are used. After prolonged electrolysis in dil. H_2SO_4 an oxidation product of the graphite is produced which yields colour reactions with KI and diphenylamine sulphate. These reactions are also obtained after graphite has been soaked in H_2O_2 and washed and after the action of H_2O vapour on graphite at 750°. It is not obtained with sugar C.

J. W. S.

Production of ozone by electrolysis. Electrolysis at low temperature. E. Briner, R. Hœfeli, and H. Paillard (Helv. Chim. Acta, 1937, **20**, 1510—1523).—By using solutions of eutectic composition the electrolytic production of O_3 at temp. down to −75° has been studied. Electrolysis of 38% H_2SO_4 at −67° gives O_3 at a concn. of about 15%, and with a current yield of 8·5%. $HClO_4$ (11·3 mol.-%) at −55° gives results almost as good. Much poorer yields are obtained from H_3PO_4, KOH, and NaOH. HNO_3 furnishes no O_3. Whilst the current yield increases with the c.d. between 10° and −5°, at the lowest temp. there is an optimal c.d. Owing to the greatly increased resistance of the solutions at low temp., the energy yields are in all cases < those given by silent discharge methods. F. L. U.

Higher oxygen compounds of iron. II. Electrochemical preparation of higher oxygen compounds of iron, and their analysis. B. A. Petrov and B. F. Ormont (J. Gen. Chem. Russ., 1937, **7**, 1690—1694).—The anolyte obtained in electrolysis of 40% NaOH at 35° (Fe electrodes) contains Fe^{VI}, but not Fe^{II}, Fe^{II}, or Fe^{VIII}. The solutions are analysed by an iodometric method. R. T.

Electrochemical researches on titanium. M. Haïssinsky and (Mme.) Emmanuel-Zavizziano (J. Chim. phys., 1937, **34**, 641—648).—At room temp. with Pt anode, aq. acid solutions of Ti salts have been electrolysed, [Ti], p_H, additants, cathode, and c.d. being varied. With the sulphate, when acidity and c.d. are adjusted to prevent pptn. of basic Ti salts, a Ti peroxide is recovered at the anode, and Ti^{III} or pertitanic acid derivatives remain in solution. NH_4 fluotitanate (Pb cathode) yields TiO. With the tartrate, and sulphate in excess of $Na_2SO_4,10H_2O$ (cf. A., 1936, 1468), giving Ti as an anionic complex, metallic Ti is obtainable. Optimum conditions are developed, including addition of H_2O_2. Cathode influence, and direct measurement (Poggendorf) using the Hg_2Cl_2 electrode, prove that a high negative cathode potential favours liberation of Ti^{IV} and decreases during its deposition. I. McA.

Electrolytic preparation of ammonium persulphate.—See B., 1938, 51.

Electroplating aluminium on metals.—See B., 1938, 70.

Penetration of electrolytes used in the anodic oxidation of aluminium.—See B., 1938, 71.

Electrodeposition of nickel-cobalt alloys.—See B., 1938, 70.

Electrodeposition of copper–nickel–zinc alloys from cyanide solutions.—See B., 1938, 70.

Behaviour of alloy anodes in deposition of silver-cadmium alloys from cyanide baths.—See B., 1938, 70.

Electrolytic reduction of ferric sulphate in presence of titanium sulphate.—See B., 1938, 75.

Electrolysis of mixtures of salts of fatty acids with halides and nitrates.—See A., II, 40.

Photochemical union of hydrogen and chlorine. V. Reaction at low pressures. Effect of light intensity in the absence of oxygen. G. V. V. Squire and A. J. Allmand. **VI. Mechanism of the reaction at low hydrogen pressures in the absence of oxygen.** H. C. Craggs, G. V. V. Squire, and A. J. Allmand. **VII. Effect of water vapour on the reaction at low pressures.** H. C. Craggs and A. J. Allmand (J.C.S., 1937, 1869—1877, 1878—1889, 1889—1891).—V. Vals. of the intensity exponent (n in the equation : rate $= kI_0^n$), determined for varying Cl_2 pressures, p_{Cl_2} (0·11—450 mm.), and at low H_2 pressure, p_{H_2} (approx. 0·1 mm.), vary between 0·05 and 1, the val. decreasing with increase in p_{Cl_2} and with increase in radiation intensity. The use of strongly absorbed radiation leads to a lower val. of n than weakly absorbed radiation. Rate of reaction and quantum yield pass through a max. with increase in p_{Cl_2} and then fall rapidly. Possible experimental errors due to varying

p_{H_2} and temp. during insolation and reaction are critically discussed.

VI. At high p_{Cl_2} the fall in the val. of n with increasing radiation intensity is suspended over a finite intensity range, during which n remains const. at 0·5, and the quantum yield $\propto p_{Cl_2}^{-2}$. The influence of added HCl is complex, retardation taking place when the rate of reaction in absence of HCl is high, and acceleration when, in absence of HCl, it is low. The results are explained by assuming the existence of Cl_3. When $n = 1$ the reaction chains are terminated by adsorption of Cl atoms and Cl_3 radicals on the vessel walls. Vals. of n between 1 and 0·5 are due to gaseous reactions $2Cl_3 \rightarrow 3Cl_2$ and, probably, $Cl + Cl_3 \rightarrow 2Cl_2$. Vals. of $n < 0·5$ are the result of localised illumination and of retarded diffusion of Cl atoms out of this zone into the dark space in the reaction cell.

VII. At total pressures 1·7—2·5 mm., H_2O retards the reaction. This is probably due to adsorption of a H_2O film on the surface of the reaction vessel which accelerates the catalytic action of the walls on Cl atoms. C. R. H.

Photographic image of a dark hot body in darkness. T. TAKÉUCHI and T. SUGITA (Proc. Imp. Acad. Tokyo, 1937, **13**, 358—359).—The image of a hot, dark body projected on a phosphorescent plate excited by filtered ultra-violet light can be transferred by contact to a panchromatic plate, which is then developed as usual. F. R. G.

Validity of the Bunsen–Roscoe law for the photographic action and course of the density curves of long-wave Röntgen rays. E. MÜLBACH (Z. wiss. Phot., 1937, **36**, 269—282).—The reciprocity law is fulfilled for the Ag $L\alpha_1$ line ($\lambda = 4·146$ A.) and the W $M\alpha_1$ line ($\lambda = 6·969$ A.), according to experiments with widely varying I and t, giving low densities; the Schwarzschild exponent p therefore $= 1$. No threshold vals. have been detected. The density curves become progressively less steep with increasing λ. J. L.

Reactivity of selenium in light and darkness. S. E. STERZEL and I. AFZELIUS (Svensk Kem. Tidskr., 1937, **49**, 281—284).—The rate of attack of Se rods by aq. Na_2SO_3 is increased by illumination. Continuous illumination has a greater effect than intermittent. M. H. M. A.

Photochemical decomposition of potassium cohaltioxalate. J. G. MURGULESCU (Bul. Soc. Ştiinţe Cluj, 1935, **8**, 193—203; Chem. Zentr., 1936, i, 4669).—The reaction $2K_3[Co(C_2O_4)_3] \rightarrow 2K_2[Co(C_2O_4)_2] + K_2C_2O_4 + 2CO_2$ in the presence of excess of K_2CrO_4 is of zero order for light of $\lambda > 313$ mμ. The limiting quantum yield is 2. J. S. A.

Photochemical reaction of dichromates with formates. P. WULFF and H. AMMANN (Compt. rend. IX Congr. int. Phot. sci. appl., 1935, 10 pp.; Chem. Zentr., 1936, i, 4668—4669).—$HCrO_4'$ and Cr_2O_7'' are reduced completely to Cr''' by $HCO_2H + HCO_2Na$ at p_H 2·5 under the influence of filtered Hg light, whereas CrO_4'' is not photochemically reduced. The rate of reduction is independent of $[Cr_2O_7'']$ and of temp., but highly dependent on the concn. of acceptor. Mo^{VI} has a pronounced, Fe a weak, catalytic influence. The primary reaction is considered to be either $Cr_2O_7'' + h\nu \rightarrow CrO_4'' + CrO_3$ or $HCrO_4' + h\nu \rightarrow OH' + CrO_3$, CrO_3 being hydrolysed unless immediately reduced. The characteristics of the reaction are related to the photographic dichromate processes. J. S. A.

Photochemistry of alkyl nitrites. III. H. W. THOMPSON and F. S. DAINTON (Trans. Faraday Soc., 1937, **33**, 1546—1555; cf. A., 1936, 544, 1178).—Previous work on the absorption spectra and photochemical decomp. of Me, Et, *sec.*-Bu, and *iso*amyl nitrites has been extended to include Pr^{α}, Pr^{β}, Bu^{γ}, and *cyclo*hexyl nitrites. The decomp. products have been analysed and a mechanism of reaction, involving the primary fission of the radical NOH and the formation of aldehydes or ketones, and in some cases of unsaturated hydrocarbons, has been advanced. The v.p. curves of the alkyl nitrites studied have been determined. E. S. H.

Mechanism of sensitisation of photochemical reactions by dyes, especially assimilation. G. SCHEIBE (Naturwiss., 1937, **25**, 795).—Positive ions of dyes are often polymerised above a certain concn. (A., 1937, I, 165). Since the polymerised dye may be composed of several hundred single mols. there is the possibility of the simultaneous absorption of many light quanta by the polymeride. There is energy exchange, if not electron exchange between the electrons of the polymeride, and this exchange occurs without loss of energy, since light absorbed is re-emitted practically without change of λ. This absorbed energy can be given up by collision, as is shown by the marked decrease in intensity of the fluorescence at higher concns. of dye. It can therefore be assumed that a foreign mol. which is coupled closely enough with this polymeride (absorption unit) could take up a large no. of quanta simultaneously with or very shortly after the absorption unit. There is thus the possibility of a concn. of quanta in the foreign mol., and the formation of very short-lived intermediate products at energy levels which could never be reached by the direct absorption of light quanta. This theory may be used to explain the process of assimilation, the absorption unit here consisting of about 2500 chlorophyll mols. It will also explain the nature of the spectra of substances with conjugated double linkings, and the photosensitisation of Ag salts by dyes. A. J. M.

Salt effects on the total light emitted by a chemiluminescent reaction.—See A., III, 69.

Production of highly concentrated emanation preparations. O. WERNER (Strahlenther., 1936, **55**, 185—190; Chem. Zentr., 1936, i, 4126).—By using dry preps. of Ra dispersed as $RaCO_3$ on $Fe(OH)_3$ (cf. Hahn and Heidenhain, A., 1926, 332), in place of solutions, an 80% yield of Rn is obtainable. J. S. A.

Action of chemical agents in the preparation of pure water. F. RIMATTEI and J. PETIT (Bull. Soc. Chim. biol., 1937, **19**, 1419—1424).—Distillation of canal-H_2O in a Pyrex glass apparatus produces a fairly good conductivity H_2O but the results are

variable. By the addition of 80 c.c. of 0·1N-H_2SO_4 + 14 c.c. of 0·1N-$K_2Cr_2O_7$ to 2 l. of canal-H_2O followed by the use of 50 c.c. of saturated aq. $Ba(OH)_2$ in series, conductivity H_2O can be regularly obtained with $\kappa = 0{\cdot}85 \times 10^{-6}$. P. G. M.

Dehydration of hydrated salts containing both water and hydrogen peroxide of crystallisation. G. R. Levi and F. Battaglino (Gazzetta, 1937, **67**, 659—663).—When Na_2SO_4, Na_3PO_4, and $Na_4P_2O_7$, containing both H_2O and H_2O_2 of crystallisation, are dehydrated under suitable conditions the H_2O is more readily eliminated than the H_2O_2. O. J. W.

Preparation of large single crystals of sodium chloride. H. Walther (Rev. Sci. Instr., 1937, [ii], **8**, 406—408).—An apparatus for making single crystals of NaCl 2 × 30 cm. is described. The crystal is formed in the melt of NaCl (30° above m.p.) on the end of a Pt rod which is raised (5 cm. per hr.) and rotated (10 revs. per hr.) continuously; the temp. gradient is obtained by means of an air stream from a circular nozzle surrounding the growing crystal. The orientation of the crystal can be predetermined by placing a seed crystal on the Pt rod. F. J. L.

Action of alkali hydroxides on cupric hydroxide. M. Paić (Compt. rend., 1937, **205**, 1063—1065).—Dil., instead of conc., solutions of alkali hydroxides have been used and the absorption spectra and electrochemical properties of $Cu(OH)_2$ in these alkali solutions investigated. The solubilities in NaOH and KOH are very similar and very dil. solutions absorb very little Cu. The Cu forms complex ions of the type $[Cu(OH)_4]Na_2$ and $[Cu(OH)_4]K_2$ and the absorption spectra are almost identical in the two cases. J. A. D.

Bromocupric complexes. A. Silberstein (Compt. rend., 1937, **205**, 909—911; cf. A., 1936, 669).—The prep. of the complex salts $(NH_4)_2[CuBr_4,2X]$ (X = NH_3, C_5H_5N, NH_2Ph, and o-$C_6H_4Me{\cdot}NH_2$) is described, and their *d* are given. The *X*-ray powder diagram of $(NH_4)_2[CuBr_4,2NH_3]$ has the same lines as that of NH_4Br, with different intensities; the structure is cubic (*a* 8·14 A.); space-group D_{4h}^{14}. A. J. E. W.

Breakdown and reduction products of silver permanganate. F. Hein (Z. anorg. Chem., 1937, **235**, 25—32).—The products of reduction of $AgMnO_4$ at room temp. and of its decomp. at 100° are definite *compounds*, in some cases giving a characteristic *X*-ray diagram. They are: $AgMnO_2$ (I); $AgMnO_{2\cdot33}$ or $3Ag_2O,2Mn_2O_3,2MnO_2,O$ (II); $Ag_2Mn_2O_5,H_2O$ (III); $AgMnO_{2\cdot63}$ or $8Ag_2O,15MnO_2,MnO_3,O$ (IV); and $AgMnO_{2\cdot94},0{\cdot}5H_2O$ or $8Ag_2O,15MnO_2,MnO_3,6O,8H_2O$ (V). (I) and (III) are obtained by the prolonged and initial action of H_2 on aq. $AgMnO_4$ respectively, (II) by the action of dil. H_2O_2 on aq. $AgMnO_4$, (IV) by decomp. of dry $AgMnO_4$ at 100°, and (V) by decomp. of $AgMnO_4$ at 100° in presence of a little H_2O. (II), (IV), and (V) all contain "inactive" O which is evolved as O_2 on treatment with $H_2C_2O_4$ in presence of H_2SO_4. F. J. G.

Reactions in the solid state at high temperatures. XV. Formation of strontium aluminates from the oxides in the solid state. W. Jander and A. Krieger (Z. anorg. Chem., 1937, **235**, 89—96).—The conclusions of Lagerqvist *et al.* (A., 1937, I, 554) regarding the compounds formed in the system SrO–Al_2O_3 have been confirmed. When $SrCO_3$ and Al_2O_3 are heated at 900—1200° in CO_2 in any proportions the first product is always SrO,Al_2O_3, and this is then more slowly transformed into $3SrO,Al_2O_3$. The other two compounds are not formed on prolonged ignition at 1200°. F. J. G.

Corrosion of zinc in distilled water alone and in presence of a gaseous atmosphere. M. F. Taboury and E. Gray (Compt. rend., 1937, **205**, 985—987).—The products of slow reaction of Zn and H_2O in absence of a gas are H_2 and $Zn(OH)_2$; in presence of air reaction is relatively rapid and the products are $3ZnO,CO_2,2H_2O$ and $4ZnO,CO_2,3H_2O$; in presence of CO_2, Zn acquires a protective film. E. S. H.

Powdered zinc and cadmium for *X*-ray scattering. W. A. Bruce (Rev. Sci. Instr., 1937, [ii], **8**, 451).—Strain-free crystals of Zn of size $<10^{-4}$ cm. are obtained by distilling powdered Zn at 413° along a Pyrex tube with a temp. gradient of 10° per cm. Similar Cd crystals are obtained by distillation at 317°. F. J. L.

Chemistry and morphology of basic salts of bivalent metals. VI. Basic cadmium chlorides. W. Feitknecht [with W. Gerber] (Helv. Chim. Acta, 1937, **20**, 1344—1372; cf. A., 1937, I, 225).—By incompletely pptg. $CdCl_2$ solutions with aq. NaOH or NH_3, or by treating pptd. $Cd(OH)_2$ with aq. $CdCl_2$, a series of basic chlorides varying in composition from $CdCl_2,Cd(OH)_2$ to $CdCl_2,4Cd(OH)_2$ is obtained. Five of these are individuals which, whilst susceptible to small variations in composition, exhibit characteristic forms and distinct *X*-ray patterns. F. L. U.

Crystalline boric oxide. L. McCulloch (J. Amer. Chem. Soc., 1937, **59**, 2650—2652).—Cryst. B_2O_3 has been obtained by keeping fused B_2O_3 (containing 8—15% H_2O) at 225—250° for some days. By "seeding" the liquid the change occurs immediately. Anhyd. cryst. B_2O_3 has *d* 2·42, m.p. 460—470°; the solubility curve in H_2O has been determined. E. S. H.

Preparation of aluminium sulphide in benzine solution. S. M. Veller (J. Gen. Chem. Russ., 1937, **7**, 1819—1820).—Al_2S_3 is pptd. by H_2S from a solution of Al naphthenate in benzine. R. T.

Hydrates of aluminium fluoride. V. S. Jatlov and A. I. Zelinskaja (J. Gen. Chem. Russ., 1937, **7**, 1787—1790).—The existence of $AlF_3,0{\cdot}5$, 3, and $9H_2O$, but not 1 and $3{\cdot}5H_2O$, is confirmed. R. T.

Gallium. V. W. Pugh (J.C.S., 1937, 1959—1962).—The prep. and physical properties of the following *complex gallifluorides* are described: $[M(H_2O)_6][GaF_5,H_2O]$, where M = Mn, Co, Ni, Cu, Zn, and Cd; $Ba_3[GaF_6]_2,H_2O$; $3SrF_2,GaF_3,3H_2O$; $Ag_3[GaF_6],10H_2O$; $Tl_2[GaF_5,H_2O]$. C. R. H.

Rare earths. XLVII. Preparation of the anhydrous iodides of the rare earths. W. A.

TAEBEL and B. S. HOPKINS (Z. anorg. Chem., 1937, **235**, 62—64).—Anhyd. *iodides* of La, Ce, Pr, Nd, Sm, and Yb have been prepared by heating the oxides with NH_4I at 400°, the excess of the latter being removed by sublimation in vac. at 190°. They are green powders, very hygroscopic, and readily sol. in C_5H_5N and EtOH. On exposure to air they form basic salts. F. J. G.

Preparation and crystal structure of the compounds $TlAlF_4$ and Tl_2AlF_5. C. BROSSET (Z. anorg. Chem., 1937, **235**, 139—147).—By the interaction of TlF and AlF_3 in aq. HF the *compounds* $TlAlF_4$ (ρ 6·09) and Tl_2AlF_5 (ρ 5·53) are formed. The compound $Tl_3Al_2F_9$ (A., 1909, ii, 236) could not be obtained and was probably a mixture. $TlAlF_4$ is tetragonal, *a* 3·61, *c* 6·37 A.; space-group D_{4h}^1. Tl_2AlF_5 is rhombic, *a* 10·06, *b* 8·24, *c* 7·46 A., with four mols. in the unit cell; space-group D_2^5. In both structures AlF_6 octahedra are present; in $TlAlF_4$ four, and in Tl_2AlF_5 two, of the F ions are common to two octahedra. F. J. G.

Silicates. VII. Magnesium metasilicate obtained by the thermal decomposition of talc. E. THILO (Ber., 1937, **70**, [*B*], 2373—2381).—Metatalc (I), $MgSiO_3$, obtained by Haraldsen by the ignition of talc, is also obtained from olivine + SiO_2 or from MgO + SiO_2 at 1250° by reaction in the solid state. In presence of LiF as mineralisator, (I) is transformed at 790° into enstatite (II) whilst under these conditions amorphous SiO_2 gives quartz. Conversion of (II) into (I) at 1250° is not observed even after addition of MgO, SiO_2, or (I). The pronounced tendency is for (II) to pass into clinoenstatite (III). The Röntgen diagrams of the products obtained from talc and the molten chlorides of bivalent metals show that only (I) is formed with $MgCl_2$ at about 800° whereas with $CoCl_2$ and $MnCl_2$ a mixture of (I) and (II) possibly containing (III) results. H. W.

Reactions of silicates with sulphur dioxide. T. VON TAKÁTS (Glastech. Ber., 1936, **14**, 103—105; Chem. Zentr., 1936, i, 4345).—Silicates react with SO_2 readily at 300—550°, sulphates being formed in presence of O_2. Failures in Pb-rich glazes may be attributed to the formation of $PbSO_4$. J. S. A.

Chemistry of germanium. E. EINECKE (Chem.-Ztg., 1937, **61**, 989—991, 1011—1014).—A summary and bibliography. J. W. S.

Zirconium and its compounds. E. I. KRETSCH (J. Appl. Chem. Russ., 1937, **10**, 1931—1947).—A review. R. T.

Preparation and properties of bismuth subiodides.—See B., 1938, 102.

Reduction of chromic oxide by hydrogen and solid carbon. W. BAUKLOH and G. HENKE (Z. anorg. Chem., 1937, **234**, 307—310).—With a rapid current of thoroughly dried H_2, Cr_2O_3 is reduced appreciably at 1000° and completely in 6 hr. at 1400°. Admixture of finely-divided Fe much accelerates the reaction, which now begins at 900° and is complete in 5·5 hr. at 1200°. With pure C reduction begins at 1000° and is complete in 8 hr. at 1100°. Fe accelerates the reduction at the lower temp. but not at the higher, apparently owing to combination with C. F. J. G.

Dependence of action of ammonium persulphate on aqueous chromic acid on the way in which it is introduced into the solution. N. D. PODOBED (J. Gen. Chem. Russ., 1937, **7**, 1972—1978).—Reduction of Cr^{VI} to Cr^{III} is observed when cryst. $(NH_4)_2S_2O_8$ is added to acid aq. CrO_3, probably as a result of the reactions $(NH_4)_2S_2O_8 + H_2O \rightarrow H_2O_2$; $Cr_2O_7'' + 7H_2O_2 \rightarrow 2CrO_8'''$; $2CrO_8''' + 12H^{\cdot} \rightarrow 2Cr^{\cdot\cdot\cdot} + 6H_2O + 5O_2$. This reaction does not take place when $(NH_4)_2S_2O_8$ is added as a solution or in presence of $Ag^{\cdot}$. R. T.

Reactions in the solid state between synthetic or mineral ferrous chromite and magnesium oxide or magnesium carbonate. J. A. HEDVALL and V. NY (Z. anorg. Chem., 1937, **235**, 148—152).—The reaction MgO + FeO,Cr_2O_3 = FeO + MgO,Cr_2O_3 has been studied. Synthetic FeO,Cr_2O_3 reacts much more rapidly than the mineral, and fine grinding increases the reaction rate. When $MgCO_3$ is used instead of MgO the reaction begins at lower temp. owing to the formation of " nascent " MgO. F. J. G.

Single-shelled malonato-complexes in the dissolved state. H. BRINTZINGER and F. JAHN (Z. anorg. Chem., 1937, **235**, 115—119).—By the method of dialysis it has been found that the malonato-complex ions of tervalent metals have the simple formula $[M(C_3H_2O_4)_3]^{3-}$ (where M = V, Cr, Mn, Co, Pr, Nd) whilst those of bivalent metals have the doubled formula $[M_2(C_3H_2O_4)_4]^{-4}$ (where M = Fe, Co, Ni, Cu, Mg, Zn, Cd). $[VO(C_3H_2O_4)_2]^{2-}$, $[UO_2(C_3H_2O_4)_2]^{2-}$, and $[Th(C_3H_2O_4)_4]^{4-}$ have the simple formulæ, as shown. It is suggested that salts of bivalent metals with dicarboxylic acids should be formulated thus: $M{:}(CO_2{\cdot}R{\cdot}CO_2)_2{:}M$, and their complex ions thus: $[(RC_2O_4)M{:}(CO_2{\cdot}R{\cdot}CO_2)_2{:}M(RC_2O_4)]^{4-}$. F. J. G.

Double-shelled malonato-complexes of various cobaltic and chromic ammines in the dissolved state. H. BRINTZINGER and F. JAHN (Z. anorg. Chem., 1937, **235**, 120—123).—By the method of dialysis it has been shown that a large no. of complex ammino-cobaltic or -chromic cations unite in solution with four malonate ions to form double-shelled complex anions. F. J. G.

Double-shelled succinato-complexes of various cobaltic and chromic ammines in the dissolved state. H. BRINTZINGER and F. JAHN (Z. anorg. Chem., 1937, **235**, 124—125).—By the method of dialysis it has been shown that a large no. of complex ammino-cobaltic or -chromic cations unite in solution with four succinate ions to form double-shelled complex anions. F. J. G.

Double-shelled citrato-complexes of various cobaltic and chromic ammines in the dissolved state. H. BRINTZINGER and F. JAHN (Z. anorg. Chem., 1937, **235**, 126—128).—By the method of dialysis it has been shown that a large no. of complex ammino-cobaltic and -chromic cations unite in solution with four citrate ions to form double-shelled complex anions. F. J. G.

Crystalline molybdenum-blue. V. AUGER (Compt. rend., 1937, **205**, 1070—1072).—Cryst. hydrated Mo suboxides have been prepared. Different conditions of prep. are given but the exact constitution of the product is not known. It is possible that there is a reaction between the amorphous material and the molybdic acid resulting in the formation of a complex cryst. compound. J. A. D.

Exact conditions of formation of the compound between tungstic acid and 8-hydroxyquinoline. S. HALBERSTADT (Compt. rend., 1937, **205**, 987—989).—$WO_2(C_{10}H_6ON)_2$ is pptd. quantitatively between p_H 3·5 and 3·3. The presence of BO_3''' and PO_4''' does not interfere. E. S. H.

Fluoronitrites and fluoronitrates. G. BECK (Z. anorg. Chem., 1937, **235**, 77—82).—The relationship between mol. vol. and binding energy (A., 1937, I, 464) suggests that NF_3 should combine with basic oxides. By the action of HF on nitrites, nitrates, and perchlorates, the following *compounds* have been obtained: Na_3NF_6 (ρ 2·229); K_2NOF_3 (ρ 2·411) (this gives pptn. reactions similar to those of K_2SO_4); $K_2N_2O_5F_2$ (ρ 2·411) (this is apparently only one of many compounds intermediate between KNO_3 and KNF_6); $2Tl(N_2O_5F),Tl_2(N_2O_4F_4)$; and K_2ClF_7 (or $KClF_6$,KF). In a similar way *K fluorocarbonate* is formed. F. J. G.

Comparative action of potassium iodate and potassium periodate on sodium thiosulphate in a slightly acid medium. É. CARRIÈRE and M. DELPLA (Compt. rend., 1937, **205**, 1157—1158).—In 0·07N-HCl KIO_4 has a more powerful oxidising action than KIO_3; in 0·2N-HCl the reverse is the case. The degree of oxidation is measured by the quantity of $NaHSO_4$ formed. [H^+] and temp. considerably influence the oxidising action of KIO_3, but with KIO_4 these influences are less marked. A. J. E. W.

Chemistry and electrochemistry of rhenium. V. Complex thiocyanates of rhenium, and rhenium^V oxychloride. H. HÖLEMANN (Z. anorg. Chem., 1937, **235**, 1—24).—Various methods for prep. and analysis of the coloured Re thiocyanate compound (A., 1932, 1224) have been studied. The findings of Druce (A., 1935, 593) were not completely confirmed. The substance could not be obtained free from the reducing agent used in its prep., so that analyses lead to no definite conclusions as to the valency of the Re. It gives coloured ppts. with $Ag^{\cdot}$, $Cu^{\cdot}$, $Cu^{\cdot\cdot}$, $Hg^{\cdot}$, $Hg^{\cdot\cdot}$, $Tl^{\cdot}$, and $Pb^{\cdot\cdot}$, and methods for the analysis of the Ag, Cu, Hg, and Tl compounds were worked out. They are all contaminated with excess of the heavy-metal thiocyanate, but the results indicate that the valency of the Re is <6 and probably $= 5$. The existence of the compound K_2ReOCl_5 (A., 1934, 1320) has been confirmed; a no. of its reactions have been studied and are contrasted with those of K_2ReCl_6. With thiocyanate, K_2ReOCl_5 gives reactions which are similar to those of perrhenate solutions on reduction in presence of thiocyanate. F. J. G.

Preparation of two lower oxides of rhenium. R. C. YOUNG and J. W. IRVINE, jun. (J. Amer. Chem. Soc., 1937, **59**, 2648—2650).—*Re_2O,$2H_2O$* and *ReO,H_2O* (both impure) have been obtained by reduction of $HReO_4$ by Zn and Cd, respectively. The oxides are insol. in HCl or conc. alkali, but sol. in HNO_3 or aq. Br. E. S. H.

Linear corrosion of metals. Selective corrosion of iron by the system water–sulphuric acid–propyl alcohol on three-phase boundaries. L. GINDIN and F. SCHEMJAKIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 409—412; cf. A., 1937, I, 319).—The corrosion of Fe, partly covered with paraffin, in H_2O–H_2SO_4–Pr$^{\alpha}$OH mixtures has been investigated. Concn. ranges which yield linear attack at the air–liquid and liquid–paraffin interfaces, periodic formation of films of corrosion product, and resinification of the Pr$^{\alpha}$OH are distinguished. J. W. S.

Relation to metals of sulphur solutions and of a series of organic sulphur compounds in saturated hydrocarbons. Relations to iron of ethyl and butyl mercaptan solutions in *cyclo*hexane. L. G. GINDIN, I. I. TORSUJEV, and V. A. KAZAKOVA (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 413—418).—Fe is unaffected by solutions of EtSH and BuSH in *cyclo*hexane. It is confirmed that the lamp method is satisfactory for determination of S in oils. J. W. S.

Anhydrous cyanides and cyanamides of iron, cobalt, and nickel. A. PERRET (Compt. rend., 1937, **205**, 611—613; cf. A., 1937, I, 257).—The quantities of cyanamide produced by thermal decomp. of $Fe(CN)_2$, and on heating $FeCl_3$, $NiCl_2$, and $CoCl_2$ with NaCN, at 350—550°, have been determined. At. moderate temp. formation of cyanamide is increased by admixture of 20% of reduced Fe, but the thermal stability of the cyanamides shows that the catalysis does not involve formation of FeNCN. A. J. E. W.

Oxidising properties of pyrites. J. I. MICHAILENKO and A. P. KRESCHKOV (J. Gen. Chem. Russ., 1937, **7**, 1959—1968).—FeS_2 is regarded as a salt of H_2S_2, which may exhibit oxidising properties with reducing agents (H_2, Fe, Zn, Al, Cu, Fe–P), reducing properties with oxidising agents (O_2, HNO_3, Cl_2, etc.), or may enter into oxidation–reduction reactions. R. T.

Effect of hydrogen under pressure on steel.—See B., 1938, 63.

Preparation of alkali compounds of ferric anhydride. IV. Basicity of ferrates. Chemical properties. A. D. DEL BOCA (An. Farm. Bioquim., 1935, **6**, 65—69; Chem. Zentr., 1936, i, 4696).—K_2FeO_4 cannot be reduced to K_2FeO_3 by means of cellulose at 50°. No insol. ferrites can be pptd. J. S. A.

Isolation of cementite by acid attack of ferrous materials, and its physical properties. A. TRAVERS and R. DIEBOLD (Compt. rend., 1937, **205**, 797—799).—Pure white cast Fe, containing 3·4% of C, traces of Mn, and 0·3% of Si, was treated with acid, washed with EtOH, treated with C_2HCl_3, washed with EtOH and Et_2O, and dried in N_2; the product consisted of pure Fe_3C (6·6% C). The carbide prepared by anodic attack has a straw-coloured iridescence, but when AcOH is used it is steel-grey. The Curie point is

210°. The *X*-ray spectrum has been determined. The electrode potential is approx. −0·320 v. in a medium of p_H 2·3, and becomes −0·500 v. with p_H 7·3. Fe_3C is electropositive with respect to Fe, the couple Fe_3C–Fe giving a p.d. of 0·230 v. at 18° in a neutral medium. R. S. B.

Mechanism of the decomposition of pure cementite by acids. A. TRAVERS and R. DIEBOLD (Compt. rend., 1937, **205**, 916—918; cf. A., 1923, ii, 767, and preceding abstract).—The primary reaction in the dissolution of Fe_3C in acids is the attack of Fe, which leaves a residue containing the ethylenic C skeleton; the H liberated replaces Fe, forming unsaturated hydrocarbons, the double linking not being reduced owing to the absence of catalysts. Free C, possessing strong adsorptive properties, is formed, probably owing to preferential oxidation of some of the H formed. A. J. E. W.

Nitrosopentamminocobalt salts. H. BRINTZINGER and H. PLESSING (Z. anorg. Chem., 1937, **235**, 110—114).—By the method of dialysis the cation of the red nitrosopentamminocobalt salts has been found to have the doubled formula $[Co_2(NO)_2(NH_3)_{10}]^{4+}$ or $[Co_2(NO)_2(NH_3)_{10}H_2O]^{4+}$. It is probable, but not certain, that the complex ion contains a mol. of H_2O. The existence in solution of complex anions $[CA_4]^{4-}$ where C is the nitrosopentammine radical and A is SO_4, HPO_4, $HAsO_4$, C_2O_4, $C_3H_2O_4$, or $C_6H_5O_7$ has been detected. Similar experiments with the black isomerides failed owing to their rapid decomp. F. J. G.

Ammines of the Roussin's black salt series. G. SPACU and V. ARMEANU (Bul. Soc. Ştiinţe Cluj, 1935, **8**, 299—310; Chem. Zentr., 1936, i, 4696—4697).—The *salts* $[Co(NH_3)_5Cl]R_2$; $[Co\ en_3]R_3,3H_2O$; 1:6-$[Co\ en_2Cl_2]R$; 1:2-$[Co\ en_2(NO_2)_2]R$; $[Co\{Co\ en_2(OH)_2\}_3]R_6$ and enH_2R_2, where $R = [Fe_4S_3(NO)_7]'$, are described. J. S. A.

Hydroxy-compounds of quadrivalent platinum. I. A. A. GRÜNBERG and P. M. FILINOV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 23—27).—Oxidation of K_2PtCl_4 with H_2S_2 in slightly alkaline solution, followed by addition of the neutral hydrochloride of the bases, yields ppts. of the *compounds* $(CH_2{\cdot}NH_3)_2[PtCl_4(OH)_2]$ (I) (prisms, sparingly sol. in H_2O, readily sol. in acids and alkalis) and $(NH_3Me)_2[PtCl_4(OH)_2]$ (prisms). With C_5H_5N,HCl, however, the product obtained passes rapidly into *cis*-$[Pt(C_5H_5N)_2Cl_4]$. The mechanism of this change is discussed. On heating alkaline (I) at 100° for about 1 hr. the solution becomes neutral to Me-orange, this being attributed to formation of $(CH_2{\cdot}NH_2)_2H[PtCl_3OH]$. On mixing K_2PtCl_4 oxidised by H_2O_2 with Tl_2SO_4 the *compound* $Tl_2[PtCl_4(OH)_2]$, insol. in HCl but readily sol. in H_2SO_4, is obtained. J. W. S.

Hydroxy-compounds of quadrivalent platinum. II. A. A. GRÜNBERG and F. M. FILINOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 907—919; cf. preceding abstract).—The compound $[Pt,4NH_3][PtCl_4(OH)_2]$ (I) has been obtained by interaction of $[Pt,4NH_3]Cl_2$ and $(NH_4)_2[PtCl_4(OH)_2]$ in aq. solution and the isomeric $[Pt,4NH_3,(OH)_2][PtCl_4]$ (II) by reaction of $[Pt,4NH_3,(OH)_2]SO_4$ with K_2PtCl_4. With H_2SO_4 (I) yields $[Pt,4NH_3,Cl_2]SO_4$. On addition of H_2SO_4 to (II) isomeric change to (I) occurs, and the $[PtCl_4]''$ and $[Pt,4NH_3]^{\cdot\cdot}$ present during this change unite to form Magnus' salt, which separates. The equilibrium $[Pt,4NH_3][PtCl_6] \rightleftharpoons [Pt,4NH_3,Cl_2][PtCl_4]$ exists in solution. The results indicate that if there are present in solution together ions of the same metal having different co-ordinated groups and different charges tautomeric equilibrium will be established between them, the equilibrium const. being determined by the ratio of the oxidation-reduction potentials of the constituent systems. R. C.

Co-ordination compounds. E. G. COX (Sci. Progr., 1938, **32**, 463—478).—A review.

Nomenclature of co-ordination compounds. S. ŠKRAMOVSKÝ (Chem. Listy, 1937, **31**, 478—480).—A discussion. R. T.

Quantitative emission spectrum analysis. A. RIVAS (Angew. Chem., 1937, **50**, 903—905).—The material (*e.g.*, metal alloy) is dissolved, and a definite amount of the solution, *e.g.* 0·01 c.c., is applied to a C spark electrode. The method is applicable also to arc spectrography. J. S. A.

Determination of sensitivity of drop reactions. N. A. TANANAEV and A. N. ROMANIUK (J. Appl. Chem. Russ., 1937, **10**, 1624—1627).—The least amount of a no. of cations detectable by known drop reactions is determined. R. T.

Determination of solid content of salt solutions. V. S. KRASNOVA (J. Gen. Chem. Russ., 1937, **7**, 1979—1981).—Sörensen's method is applicable only to sea-H_2O of a high Cl′ content, such as that of the Polar seas, but gives low results for H_2O of a relatively high [$Mg^{\cdot\cdot}$], and a low [Cl′], such as that of the Caspian Sea. In such cases Efremov's method is preferred. R. T.

Modified chromatographic technique. H. FLOOD (Tids. Kjemi, 1937, **17**, 178—179).—Inorg. salt solutions are analysed chromatographically by passing them through a pad of folded filter-papers impregnated with a zeolite. The pad is then unfolded and the sections are "developed" by treatment with suitable reagents for the ions in question. M. H. M. A.

Precision colorimetric determination of p_H. C. DU RIETZ [with S. HÄHNEL] (Svensk Kem. Tidskr., 1937, **49**, 284—298).—The theory of colorimetry with one- and two-colour indicators is discussed in detail, and corrections are worked out for deviations from the Lambert–Beer law. Eleven commercial sulphonephthalein-type p_H indicators have been studied in the Pulfrich photometer and their consts. determined. The effect of impurities in the indicator is discussed. M. H. M. A.

Application of the glass electrode to the measurement of the p_H of slightly buffered and unbuffered solutions. E. G. EDWARDS and D. P. EVANS (J.C.S., 1937, 1938—1942).—Alkaline drift is avoided by using a large vol. of liquid and agitating it with purified air, the small amount of alkali dissolved from the glass causing a negligible change in p_H when dispersed through the liquid. C. R. H.

Acidimetry and alkalimetry with fluorescent indicators. Y. VOLMAR (Document. sci., 1936, **5**, 33—39; Chem. Zentr., 1936, i, 4332).—The use of fluorescein, acridine, umbelliferone, and quinine is described (cf. A., 1936, 810, 1081). J. S. A.

Mercurous perchlorate as a volumetric reagent for chlorides and bromides. W. PUGH (J.C.S., 1937, 1824—1825).—$HgClO_4$ [prepared by shaking red HgO (22 g.), $HClO_4$ (*d* 1·5; 45 g.), H_2O (50 c.c.), and Hg (30 g.) until free from $Hg^{\cdot\cdot}$, decanting from the Hg, and diluting to 2 l.] can be used for titration of Cl′ and Br′, using bromophenol-blue as adsorption indicator. HNO_3, $HClO_4$, and AcOH have no effect on the results at total acid concn. $\geq$0·04N. SO_4'' causes high titres, and should be removed by adding $Pb(NO_3)_2$ to the boiling solution, but $Ag^{\cdot}$ and $Hg^{\cdot}$ are the only cations which interfere. The $HgClO_4$ solutions are fairly stable when kept in the dark. J. W. S.

Analytical chemistry of rhenium. XIII. Determination of chlorine in rhenium compounds. W. GEILMANN and G. LANGE (Z. anorg. Chem., 1937, **234**, 289—297).—The presence of excess of perrhenate does not interfere with the determination of Cl by pptn. as AgCl, either gravimetrically or volumetrically using Mohr's, Volhard's, or the potentiometric method. Methods available for breaking up the Cl compounds of Re include heating with aq. NaOH and H_2O_2, fusion with NaOH and Na_2O_2, ignition with $CaCO_3$, and reduction in a current of H_2. Of these the first is the most generally applicable. F. J. G.

Mercurimetric determination of chloride in presence of sulphite, thiosulphate, dithionate, sulphide, or nitrite. E. VOTOČEK (Chem. Listy, 1937, **31**, 500—501).—The above ions are oxidised by $KMnO_4$ in acid solution, excess of $KMnO_4$ is removed by $H_2C_2O_4$, and the solution is titrated with standard $Hg(NO_3)_2$ in presence of Na nitroprusside. R. T.

New method of chemical analysis. I. S. SHINKAI. **II. Determination of anions.** S. SHINKAI and T. NAGATA (J. Soc. Chem. Ind. Japan, 1937, **40**, 348B, 349B).—I. In gravimetric analysis the wt. of the ppt., if small in comparison with the vol. of the reacting solutions, can be determined from the vol. and *d* of the sample solution, reagent, and filtrate by means of the formula $m = d_1V_1 + d_2V_2 - d_3V_3$ where *m* is the wt. of the ppt. and d_1, V_1, d_2, V_2, d_3, V_3 refer to the *d* and vol. of the sample solution, reagent solution, and filtrate, respectively. The method is applied to the determination of Ag.

II. The method is applied to the determination of Cl′, Br′, and SO_4''. C. R. H.

Pycnometric analysis. W. W. RUSSELL (Ind. Eng. Chem. [Anal.], 1937, **9**, 592—597).—A rapid method, in which a purified ppt. is transferred quantitatively to a small pycnometer and weighed in presence of a liquid of known *d*, is described. Analyses involving AgCl, $BaSO_4$, and $Fe(OH)_3$ indicate that the method is accurate. Sources of error in a pycnometric method of analysis and advantages of the present method over orthodox gravimetric methods are discussed. L. S. T.

Determination of iodates. V. J. ANHORN and H. HUNT (Ind. Eng. Chem. [Anal.], 1937, **9**, 591).—A method involving the use of wt. burettes of 1 ml. capacity and the colour of free I as indicator is described for the determination of 0·3 mg. of KIO_3. The method is more accurate and more convenient than the starch indicator method (A., 1931, 325) or the I–CN procedure (A., 1926, 139). L. S. T.

Assay of [pharmacopœial] solution of iodine.—See B., 1938, 102.

Titration of fluorine in aqueous solutions. R. J. ROWLEY and H. V. CHURCHILL (Ind. Eng. Chem. [Anal.], 1937, **9**, 551—552).—F′ can be accurately titrated with 0·1N-$Th(NO_3)_4$ in aq. instead of in 48% EtOH solution, as recommended in the Willard–Winter method, when the p_H is adjusted to 2·9—3·1 by means of a buffer of $CH_2Cl{\cdot}CO_2H$ half neutralised by NaOH. The end-point is more definite, and larger quantities of F′, up to 50 mg., can be titrated. L. S. T.

Iodometric determination of small amounts of persulphate and bromate present in the same solution. F. LÁSKA (Chem. Listy, 1937, **31**, 404—406).—S_2O_8'' is determined by the method of Zombory (A., 1928, 497), in neutral solution, and BrO_3' by that of Kolthoff (Z. anal. Chem., 1921, **60**, 348), in acid solution. R. T.

Stability of solid sodium thiosulphate. V. K. LA MER and H. M. TOMLINSON (Ind. Eng. Chem. [Anal.], 1937, **9**, 588).—Solid $Na_2S_2O_3$ decomposes slowly into S and Na_2SO_3. The deterioration of solutions of freshly recryst. $Na_2S_2O_3$ is no more rapid than that of solutions prepared from crystals not recently recryst. L. S. T.

Determination of sulphur in different forms of combination in medicaments.—See B., 1938, 102.

Determination of sulphur in brown-coal pyrites.—See B., 1938, 11.

Qualitative separations on a micro-scale. III. Analysis of the selenium group of Noyes and Bray. A. A. BENEDETTI-PICHLER and J. R. RACHELE (Ind. Eng. Chem. [Anal.], 1937, **9**, 589—591).—The scheme of Noyes and Bray has been adapted, after modification, to the micro-scale, starting with 1 mg. of solid material. With the procedure given 5 μg. of Se, Ge, or As can be detected when accompanied by 500 μg. of the other two elements of the group. A screw clamp for microcones enables pressure digestions to be performed without loss, and a buzzer accelerates the complete pptn. of the $MgNH_4AsO_4,6H_2O$ and the flocculation of the colloidal GeS_2 in the cones. L. S. T.

Determination of ammonia in presence of amino-acids [by Folin's method]. V. P. HIRSJÄRVI (Suomen Kem., 1937, **10**, A, 153—156).—The standard method is modified by freeing the air-stream from CO_2 before drawing it, at 100 l. per hr., through the reaction vessel which is kept at 50°. M. H. M. A.

Determination of nitrates in water in presence of nitrites. G. GAD (Gas- u. Wasserfach, 1938, **81**, 6).—To determine NO_3' by the brucine method

NO_2' must first be destroyed. $CO(NH_2)_2$ is unsuitable for this purpose, results being low even when excess of the reagent is avoided, but NaN_3, $(NH_4)_2SO_4$ and p-$NH_2 \cdot C_6H_4 \cdot NO_2$ can be used under the conditions described. A. R. Pe.

Detection of nitrate in the presence of nitrite. H. Schneider (Angew. Chem., 1937, **50**, 906).—NO_2' gives an immediate orange-brown coloration on the addition of conc. $H_2SO_4 + C_6H_6$, but $PhNO_2$ (detected by its odour after evaporation of a drop of the C_6H_6) is formed only in the presence of NO_3'. J. S. A.

Photometric determination of added phosphorus in oils.—See B., 1938, 52.

Analysis of crude phosphorus and sludges containing phosphorus.—See B., 1938, 52.

Arsenious oxide in the standardisation of solutions of potassium permanganate. H. A. Bright (Ind. Eng. Chem. [Anal.], 1937, **9**, 577—578).—Standardisation of 0·1N-$KMnO_4$ solutions against As_2O_3 using KI or KIO_3 as catalyst (A., 1926, 581), and against $Na_2C_2O_4$ as in Fowler and Bright's procedure (A., 1936, 304), gave vals. which agreed to 1 in 3000, showing As_2O_3 to be a suitable primary standard. L. S. T.

Determination of silicon in aluminium.—See B., 1938, 69.

Microgasometric analysis with the dilatometer. Determination of the carbonate radical. B. L. Clarke and H. W. Hermance (Ind. Eng. Chem. [Anal.], 1937, **9**, 597—598).—The CO_2 is liberated by heating a few mg. of the carbonate with fused $K_2S_2O_7$ in a micro-retort and its vol. measured by means of an attached Hg-thread dilatometer. Results obtained with cerussite are recorded. L. S. T.

Rapid method for accurate determination of helium (neon) in gas mixtures. E. Schröer (Z. anal. Chem., 1937, **111**, 161—168).—Apparatus is described for the determination of He or Ne by a modification of the Paneth–Peters method, SiO_2 gel being used as adsorbent. J. S. A.

Determination of potassium by the Shohl–Bennett method. E. R. Hartzler (J. Biol. Chem., 1938, **122**, 19—20).—Refinements in technique are described whereby 0·04 mg. of K can be determined. P. G. M.

Choice of indicator in determining the alkalinity of ashes.—See B., 1938, 51.

Electrometric determination of silver. H. Robinson and H. Hugg (Ind. Eng. Chem. [Anal.], 1937, **9**, 565—566).—The Ag, as nitrate, is titrated with KI using a Au electrode and a C electrode, saturated with HNO_3, connected to a microammeter. The first excess of KI generates sufficient current through oxidation by the HNO_3–C electrode to be read directly on the ammeter, neither amplifier nor balancing circuit being required. Pb, Cu, Cd, Ni, Co, and Zn in concns. up to 55% do not interfere, and suspended metastannic acid, traces of Sb, Al, and colloidal Au have no effect. When Fe is present a balancing circuit must be used. Pd must be absent. SO_4'' renders the end-point uncertain, and the C electrode must then be saturated with 0·1N-$Ce(SO_4)_2$. The method is accurate up to 50°. L. S. T.

Determination of radium, mesothorium I, and radiothorium in sealed preparations. G. V. Gorschkov and V. N. Ionov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 15—18).—Mixtures can be analysed by measurement of the effects of their γ-radiations in expelling neutrons from D_2O (giving the Ra-Th content) and from Be (yielding the content of Ra-Th + Ra). Combination of the results with the total γ-ray activity yields the meso-Th I content. J. W. S.

Separation of magnesium as oxalate by precipitation in concentrated acetic acid solution. P. J. Elving and E. R. Caley (Ind. Eng. Chem. [Anal.], 1937, **9**, 558—562).—Details for the determination in 85% AcOH are given. The ppt. can be converted into and weighed as oxide or sulphate, or the oxalate can be determined volumetrically. The alkalis can be determined in the filtrate after the separation of Mg by this method, but double pptns. of the oxalate are required for accurate results in certain cases. Large amounts of Na, as from a carbonate fusion, cannot be separated conveniently. NH_4 salts in excessive amounts must be removed, preferably by means of HNO_3 and $HClO_4$. Heavy metals and alkaline earths must be absent. Applications of the method to the Mg in limestone and dolomite are described. L. S. T.

Analytical application of 2 : 2′-dipyridyl. C. Ferrari (Annali Chim. Appl., 1937, **27**, 479—482).—Mg, Be, Al, or Ti can be determined in aq. solution in presence of Fe^{III} salts by reduction of $Fe^{\cdots}$ to $Fe^{\cdot\cdot}$ and addition of 2 : 2′-dipyridyl, which forms $[Fe\,dipy_3]^{\cdot\cdot}$ (I). Excessive amounts of Fe are removed as the perchlorate of (I). F. O. H.

p_H studies of milk of magnesia with the glass electrode.—See B., 1938, 101.

Modification of the palmitate determination of magnesia in water.—See B., 1938, 111.

(A) Micro-separation of zinc with 8-hydroxyquinoline in acetic acid. (B) Volumetric microdetermination of zinc in an alkaline medium. C. Cimerman and P. Wenger (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 98—101; cf. A., 1936, 1352).—(A) Complete separation from $NH_4^{\cdot}$, $K^{\cdot}$, $Na^{\cdot}$, $Li^{\cdot}$, and $Mg^{\cdot\cdot}$ can be effected by suitable adjustment of the vol. of solution and the concns. of NaOAc and AcOH present; the appropriate quantities are specified.

(B) Tartaric acid and excess of NaOH are added to the $Zn^{\cdot\cdot}$ solution; a slight excess of a 1% EtOH solution of 8-hydroxyquinoline is added in the cold. After 15 min. the liquid is heated, and after 45 min. the ppt. is collected and treated as in the AcOH method. A. J. E. W.

Spectrographic determination of impurities in cadmium.—See B., 1938, 66.

Determination of traces of heavy metals in mineral waters.—See B., 1938, 111.

Determination of lead by the sulphite method. J. Hanuš and V. Hovorka (Chem. Listy, 1937, **31**, 489—500).—A litre of H_2O at 100° dissolves

approx. 2 mg. of $PbSO_3$. In determining Pb as $PbSO_3$, pptd. by $Na_2S_2O_5$ from neutral solution, this loss is compensated by adsorption of ions from the solution. Should the latter contain NH_4OAc, the ppt. should bo dried at $\not>90°$, whilst when it contains only Cl′, NO_3′, or tartrate a temp. of 115° may be applied. The method serves for determination of 0·0009—0·75 g. of Pb in sol. and insol. salts. R. T.

Separation of lead from antimony. V. Hovorka (Chem. Listy, 1937, **31**, 501—507).—2 g. of NH_4 tartrate are added to the ammoniacal solution containing $\not>0·2$ g. each of Sb and Pb, and Pb is pptd. as $PbSO_3$ from the boiling solution by means of $Na_2S_2O_5$. R. T.

$[Fe(CN)_6]'''$-$Pb_2[Fe(CN)_6]$ electrode as an indicator in the potentiometric titration of lead. A. B. Schachkeldian (J. Appl. Chem. Russ., 1937, **10**, 1706—1710).—The solubility coeff. of $Pb_2[Fe(CN)_6]$ (I) is 5×10^{-16}. Electro-titration of Pb^{II} by Na phosphate is effected with a Pt in $K_3Fe(CN)_6$–(I) electrode, for $\not<0·005$M-Pb^{II}. R. T.

Separation of lead from arsenic. V. Hovorka (Chem. Listy, 1937, **31**, 414—419).—$PbHAsO_4$ is converted by heating at 100° with aq. $Na_2S_2O_5$ into $PbSO_3$ containing $\not>$ traces of As. R. T.

Use of potassium ferrocyanide for potentiometric determination of copper. F. K. Fischer (J. Appl. Chem. Russ., 1937, **10**, 1687—1692).—Cu^{II} solutions are electro-titrated with $K_4Fe(CN)_6$, using a Pt electrode. $Ag^{\cdot}$ can be titrated in the same solution, with a Ag electrode. R. T.

Colorimetric determination of copper. J. Šebor (Chem. Listy, 1937, **31**, 419—420).—The most sensitive method is that involving the use of 1 : 2-diaminoanthraquinonesulphonic acid. The methods involving use of aq. NH_3, $K_4Fe(CN)_6$, alone or with citric acid, or of Na_2S can be applied only over a narrow range of concns. R. T.

Application of sodium nitroprusside to determination of copper, cadmium, cobalt, and nickel. O. Tomíček and J. Kubík (Chem. Listy, 1937, **31**, 471—478).—The solubilities of some nitroprussides in H_2O at 20° are: Cd 3, Co 2, and Ni and Cu $0·6 \times 10^{-4}$ g.-mol. per litre. To determine Cu and Ni, excess of 0·05M-$Na_2Fe(CN)_5NO$ (I) is added to 10 ml. of approx. 0·05M-Cu^{II} or -Ni in dil. H_2SO_4, the vol. is made up to 50 c.c. after 12 hr. (final $[H_2SO_4] = 0·05$M), the solution is centrifuged, and an aliquot part of the centrifugate is electro-titrated with 0·1N-$AgNO_3$, to determine excess of (I) used. Co is determined similarly, without adding H_2SO_4. In the case of Cd 10—15 ml. of EtOH are added in place of H_2SO_4, and the solution is filtered instead of being centrifuged. R. T.

Dithizone processes in chemical analysis. H. Fischer (Angew. Chem., 1937, **50**, 919—932).—The subjects discussed include the absorption curve of dithizone (I) and its oxidation product, sources of error and their avoidance, the detection and determination of Cu, Ag, Au, Zn, Cd, Hg, In, Tl, Pb, Bi, Sn, Mn, Fe, Co, Ni, Pd, and Pt, and the application of the use of (I) in various fields. L. S. T.

Zinc sulphide as a reagent for fractional detection of mercury, copper, and cadmium. M. Schtschigol (J. Appl. Chem. Russ., 1937, **10**, 1644—1645).—An equal vol. of 10% KI is added to the solution, followed by 20% NaOH + Na_2CO_3 to a strongly alkaline reaction, and the solution is boiled and filtered, and the filtrate heated with ZnS; a black ppt. of HgS forms. The ppt. is boiled with $(NH_4)_2SO_4$ in aq. NH_3, the solution is filtered, and the filtrate is warmed with ZnS; a brown ppt. indicates Cu. A second portion of filtrate is decolorised with KCN, and ZnS is added; a yellow ppt. indicates CdS. R. T.

Electrometric titration of mercurous salts in presence of mercuric salts. E. Michalski (Rocz. Chem., 1937, **17**, 578—584).—Electrotitration of Hg^{I} in presence of Hg^{II} is effected by adding the solution from a burette to standard I in KI solution, until a zero galvanometer reading is obtained. NH_4, Ca, Mg, Ni, Co, Mn^{II}, Zn, Cr^{III}, Al, Ag, Pb, and Bi do not interfere. R. T.

Volumetric determination of aluminium by means of pyrogallol. A. V. Pavlinova (J. Appl. Chem. Russ., 1937, **10**, 1718—1720).—Pptn. of $Al(OH)_3$ is not prevented by glycerol, mannitol, glucose, or sucrose; pyrogallol (I) (1 mol. per Al''') prevents pptn., and liberates an equiv. amount of acid from Al salts, according to the reaction $Al''' + C_6H_3(OH)_3 \rightarrow 3H^{\cdot} + C_6H_3O_3Al$. Al may be determined by titrating the free acid formed after addition of 3% aq. (I). R. T.

Detection of related elements in drops in presence of one another. II. Microchemical detection of aluminium and beryllium with ammonium molybdate. G. Kramer (Z. anal. Chem., 1937, **111**, 169—176).—Al and Be are pptd. in characteristic habit as molybdates by means of $(NH_4)_2MoO_4$ in $\not>0·2$N-HNO_3 solution, and may be so detected simultaneously. J. S. A.

Photometric methods in the analysis of light metals.—See B., 1938, 70.

Photoelectric determination of manganese and chromium in steels.—See B., 1938, 65.

Principles and applications of absolute colorimetry. XVI. Absolute colorimetric determination of iron. A. Thiel and E. van Hengel (Ber., 1937, **70**, [*B*], 2491—2497).—The method of Thiel and Peter (A., 1936, 44) for the determination of Fe by sulphosalicylic acid (I) is modified in accordance with Alten *et al.* (A., 1934, 49) by the addition of citrate. The suggestion of these authors that Fe'' gives a red coloration with (I) could not be confirmed and no correction is necessary on this account in the actual determination. Fe''' can be accurately determined by the green colour developed with 7-iodo-8-hydroxyquinoline-5-sulphonic acid in solution which is just distinctly acidic to Me-orange. Fe'' is without action. Strong acids should be partly neutralised by NH_3. Other probable foreign cations do not interfere but tartrates, citrates, and similar anions have a harmful influence on the depth of colour. Light filters SF_9 or SF_{10} are used and a compensating solution is unnecessary. Fe'' in

presence of $Fe^{\cdot\cdot\cdot}$ is determined by measurement of the latter and, after oxidation, of total $Fe^{\cdot\cdot\cdot}$. The simplest and most sensitive reagent for $Fe^{\cdot\cdot}$ is 2 : 2′-dipyridyl, which gives a persistent, intense red colour in almost neutral solution. Foreign cations, except $Mn^{\cdot\cdot}$, do not interfere beyond necessitating the use of a larger amount of reagent. $Zn^{\cdot\cdot}$ causes a turbidity or gives a white ppt. Org. OH-acids are without effect. I in high concn., CNS, and a few infrequent anions give ppts. or changes in colour. Light filter SF_5 is used. $Fe^{\cdot\cdot\cdot}$ can be determined directly after reduction by $Na_2S_2O_4$. H. W.

Determination of small amounts of iron by means of quinaldinic acid. G. A. Butenko and B. A. Veller (J. Appl. Chem. Russ., 1937, **10**, 1662—1673).—1 g. of substance, containing $>5\%$ Al, is freed from SiO_2, the residue is dissolved, and made up to a vol. of 250—500 ml. 25—50 ml. of the solution are diluted to 70 ml., made neutral with aq. NH_3 (metanil-yellow), 3 ml. of 5% NH_2OH,HCl, 6 ml. of 1·13% Na quinaldate, 2 ml. of 10% KCN, and H_2O to 100 ml. are added, and the coloration is compared with that given by a standard solution. Should a ppt. of $Al(OH)_3$ form after addition of KCN, a further 2 ml. of 10% KCN are added, and the solution is filtered. Should Ti hydroxide separate after addition of aq. NH_3, 4 ml. of N-HCl are added, and the amount of KCN is raised to 6 ml. In presence of $PO_4^{\cdot\cdot\cdot}$ 3·5 ml. of N-HCl and 4 ml. of KCN are taken. R. T.

Histochemical detection of organic iron. C. Ferrari (Annali Chim. Appl., 1937, **27**, 487—489).—Aq. $K_4Fe(CN)_6$ does not react with NH_4HS in the dark, whilst after exposure to light the photolytic products give a ppt. of FeS. F. O. H.

Analytical application of sulphinic and seleninic acids. F. Feigl (Österr. Chem.-Ztg., 1937, **40**, 535).—Priority is claimed (cf. Dubsky *et al.*, A., 1937, I, 532). Arylsulphinic acids are suitable precipitants for Fe and quadrivalent metals. J. S. A.

Determination of potassium ferrocyanide from the point of view of the rules of residues and of replacement. N. A. Tananaev and P. F. Veresch-nia (J. Appl. Chem. Russ., 1937, **10**, 1628—1643).—Pure $K_4Fe(CN)_6$ is obtained by pptn. with EtOH from aq. solution. It can be determined as K_2CO_3 (fusion with $H_2C_2O_4$), with a mean error of $-0·2\%$ (time >1 hr.), as $K_3Fe(CN)_6$ (oxidation with Br, followed by iodometric titration; mean error $-0·15\%$; time 25 min.), or argentometrically (excess of standard $AgNO_3$ is added, the solution is filtered, and Ag is titrated in the filtrate; mean error $\pm0·10\%$; time 27 min.). $K_4Fe(CN)_6$ may serve for standardisation of $KMnO_4$, $Na_2S_2O_3$, $AgNO_3$, NH_4CNS, and acids. R. T.

Determination of iron in pharmaceutical preparations by means of ceric sulphate.—See B., 1938, 102.

Micro-determination of cobalt with anthranilic acid. P. Wenger, C. Cimerman, and A. Corbaz (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 96—98; cf. A., 1933, 924).—$Co^{\cdot\cdot}$ is pptd. as $Co(C_7H_6O_2N)_2$ in neutral or very slightly acid solution with 2% Na anthranilate (I) solution (p_H 6); the ppt. is washed with (I) solution and EtOH, dried at 120—130°, and weighed. A. J. E. W.

Electrolytic determination of nickel without the use of platinum electrodes. L. I. Favorski and G. V. Zotov (J. Appl. Chem. Russ., 1937, **10**, 1700—1705).—Ni can be determined by the Fresenius–Bergmann method, using a Ni cathode and a passivated Fe anode. R. T.

Assay of nickel in ores.—See B., 1938, 66.

Colour test for chromates and dichromates. B. K. Nandi (Current Sci., 1937, **6**, 156—157).—$CrO_4^{\cdot\cdot}$ and $Cr_2O_7^{\cdot\cdot}$ in presence of $H_2C_2O_4$ at p_H <6·5 give a transient purple colour with 8-(α-methyl-δ-diethylaminobutyl)amino-6-methoxyquinoline (plasmoquin) (I). The colour is due to partial oxidation of (I) to a semi-quinone type compound. The test is sensitive at dilutions up to 1 in 10^5. Complex acids of Mo and W give a blue colour with (I) in alkaline solution. A. J. E. W.

Titrimetric determination of alkali dichromates in neutral solution. G. Tsatsa (Praktika, 1935, **10**, 235—238; Chem. Zentr., 1936, i, 4187).—$BaCrO_4$ is pptd. by adding $BaCl_2$ + NaOAc. The AcOH liberated may then be titrated with 0·1N-KOH. The accuracy of the method makes it usable for standardising alkalis. J. S. A.

Retention of alkalis by metallic hydroxides of the chromium group. P. N. Raikov (Z. anal. Chem., 1937, **111**, 179—183).—Treatment of an aq. suspension of $Cr(OH)_3$, washed free from NH_4 salts, with CO_2 liberates NH_3. It is considered that NH_3 is bound chemically to two anhydrohydroxides, the acid strength of which is comparable with that of CO_2. $Fe(OH)_3$ and $MnO(OH)_2$, but not $Al(OH)_3$, behave similarly. J. S. A.

Determination of chromium in chromite.—See B., 1938, 67.

Colorimetric determination of zirconium. V. A. Nazarenko (J. Appl. Chem. Russ., 1937, **10**, 1696—1699).—5 ml. of 4N-HCl are added to the solution, which is evaporated down to 0·5 ml., 5 ml. of 2N-HCl and excess of 1% p-$NMe_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_4{\cdot}AsO(OH)_2$ in 5% HCl in EtOH (1 ml. per 0·1 g. Zr, + 1 ml. excess) are added, and the solution is filtered after 2 hr. The residue is washed successively with 0·08N-HCl in EtOH and with 60% EtOH, dissolved in 2N-KOH, the solution is diluted to 50—250 ml. with 2N-KOH, and the coloration is compared with that given by standard Zr solution. Ti, Th, Ce, Fe, and U do not interfere. R. T.

Determination of zirconium in ferrozirconium. R. Chandelle (Bull. Soc. chim. Belg., 1937, **46**, 423—427).—Finely powdered alloy (0·3 g.) containing no Ti is fused with Na_2O_2 (4—5 g.) in a Ni crucible for 10—15 min., the cold mass extracted with H_2O (300—400 ml.), and filtered. The ppt., containing Zr, Fe, Ni, and SiO_2, is dissolved in 5N-HCl, SiO_2 removed by usual method, and $FeCl_3$ by extraction with Et_2O. From 250 ml. of 0·5N-HCl solution

containing 0·03 g. of Zr, 1 g. of Na_2MeAsO_3 ppts. the Zr quantitatively. The ppt. is ignited to ZrO_2 (A., 1937, I, 634). K. S.

Determination of thorium by means of (A) phenylarsinic acid, (B) ammonium molybdate. L. E. KAUFMAN (J. Appl. Chem. Russ., 1937, **10**, 1648—1650, 1693—1695).—(A) The method of Rice *et al.* (A., 1926, 593) has no advantages over other methods, and is more laborious. Separation of Th from Ce depends on difference in solubility of the phenylarsinates in HCl, and not in AcOH, as proposed by Rice.

(B) Metzger's method (A., 1913, ii, 157) gives trustworthy results if pptn. is effected in 4·5—5% AcOH, instead of 6—6·6% AcOH as specified by Metzger. R. T.

Determination of vanadium, nickel, and molybdenum in sea-water. T. ERNST and H. HÖRMANN (Nachr. Ges. Wiss. Göttingen, 1936, [ii], **1**, 205—208; Chem. Zentr., 1936, i, 4344).—V, Ni, and Mo are conc. on pure $Fe(OH)_3$ as carrier, and determined spectrographically. Mean contents are V_2O_3 0·5, NiO 0·1, and MoO_3 1×10^{-6} g. per l. J. S. A.

(A) Acidimetric determination of vanadium in quinquevalent vanadium compounds by means of hydroxy-compounds. (B) Volumetric determination of vanadium by means of hydroxy-compounds. V. K. ZOLOTUCHIN (J. Appl. Chem. Russ., 1937, **10**, 1651—1655, 1656—1661).—(A) V^V is determined by the method previously described (*ibid.*, 1933, **6**, 1676), after reduction to V^{IV} by means of $H_2C_2O_4$, tartaric acid, or Mg.

(B) V^{IV} salts liberate equiv. amounts of inorg. acid from solutions of Na K tartrate (I), or of mannitol, glycerol, or sucrose. The $[V^{IV}]$ in solutions is determined by titration of the acid liberated with (I); the results differ from those obtained by $KMnO_4$ titration by $\pm 0·6\%$. R. T.

Colorimetric determination of bismuth. T. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1312—1317).—Dil. aq. Na_2S is added to a slightly acid solution of the sample in presence of gum arabic or polyvinyl alcohol. The solution is made slightly alkaline with NH_3, diluted to a standard vol., and the colour matched against a standard. The accuracy is $\pm 3\%$. E. S. H.

Precision mercury thermometers in fused quartz. H. MOREAU (Compt. rend., 1937, **205**, 967—969).—Preliminary observations show that such thermometers retain a remarkably const. zero during use. E. S. H.

Differences in gas thermometer data. V. JACYNA (Bull. Acad. Polonaise, 1937, **A**, 98—108).—The corrections applied to gas thermometric measurements at const. vol. and pressure are discussed theoretically. The three relationships $\Delta t_v \lesseqgtr \Delta t_p$. are possible and in the case of He are experimentally observed over the temp. range 4—3000° K. K. S.

Lag in the indication of thermometers. F. LIENEWEG (Wiss. Veröff. Siemens-Werken, 1937, **16**, 112—126).—The calculation of the lag in indication of thermometers of different materials, and when placed in different media, is considered. A. J. M.

Measurement of flame temperatures. G. RIBAUD (Compt. rend., 1937, **205**, 901—902).—A modification of the Kurlbaum method, in which two images of a source of variable intensity are matched photometrically, is described; the light producing one of these images is passed through the flame under test. When matching occurs, the flame temp. = the temp. of the source. Using a spectrometer, temp. of non-luminous flames can be measured by the Féry method. A. J. E. W.

Radiation thermopiles. A. H. PFUND (Rev. Sci. Instr., 1937, [ii], **8**, 417—418).—A technique for making junctions between Bi–Sb and Bi–Sn alloys without the use of solder is outlined. F. J. L.

Semi-micro-colorimeter for measuring heat capacities at low temperatures. D. R. STULL (J. Amer. Chem. Soc., 1937, **59**, 2726—2733).—The apparatus is designed for the determination of sp. heats and heats of transition and fusion of 5—6-c.c. samples of org. compounds over the temp. range 100—320° K. Data for the sp. heats of PhMe, CCl_4, PhF, PhCl, PhBr, PhI, *n*-hexane, β- and γ-methylpentane, and βγ- and ββ-dimethylbutane at 90—320° K. are recorded. ββ-Dimethylbutane undergoes a transition in the solid state at 127·11° K. E. S. H.

Radioelectric thermostat. A. L. DELAUNOIS (Arch. Int. Pharmacodyn., 1937, **57**, 64—66). D. T. B.

Method of obtaining spectra of metals. H. MURAOUR and A. MICHEL-LÉVY (Compt. rend., 1937, **205**, 1054—1055).—A modification of a previous method of obtaining the spectra of metals is described (cf. A., 1937, I, 568). The metal is now used in the form of a thin sheet 0·02 mm. thick and is pulverised by means of an explosion wave in A. J. A. D.

Device for improving the observation of lines in spectrograms. G. BOLLA (Nuovo Cim., 1937, **14**, 257—261).—A plane-parallel glass plate, which is made to oscillate with a suitable frequency and in a suitable direction, inserted between the spectrogram plate and the objective of a microscope comparator produces a sharpening of the spectral lines and overcomes the effects due to the granular nature of the photographic plate. O. J. W.

Curved quartz crystal *X*-ray spectrograph and a determination of the grating constant of quartz. B. B. WATSON (Rev. Sci. Instr., 1937, [ii], **8**, 480—485).—The construction of a small experimental spectrograph of the curved-crystal type is described. The improvement of the spectra obtained when quartz is used in place of mica or gypsum is discussed. The grating const. *d* for the basal planes of quartz is $5·393 \pm 0·002$ A. L. S. T.

Focussing method for *X*-ray powder spectroscopy. L. K. FREVEL (Rev. Sci. Instr., 1937, [ii], **8**, 475—477).—A convergent Soller type slit, adaptable to a camera of arbitrary radius, selects pencils of *X*-rays that emanate from a broad focal spot and impinge on any selected point on the equator of the cylindrical camera. The powder is mounted on the camera wall in the form of a thin sheet that intercepts the wedge of *X*-radiation. All *X*-rays

diffracted at the same Bragg angle are thus brought to a focus at the equator of the camera. L. S. T.

Focussing of *X*-rays with a crystal of variable curvature. V. DOLEJŠEK and M. TAYERLE (Compt. rend., 1937, **205**, 605—607).—The use of a rotating crystal of mechanically varied curvature, giving sharp focussing over a wide λ range, is discussed. A. J. E. W.

Adjustment of a crystal for oscillation *X*-ray photographs. O. P. HENDERSHOT (Rev. Sci. Instr., 1937, [ii], **8**, 436—438).—A systematic method for setting a single crystal, so that a zone axis coincides with the axis of rotation, by means of an oscillation *X*-ray photograph is outlined. F. J. L.

Simple *X*-ray tube with low energy consumption. Studies on the wide-angle method. B. HESS (Z. Krist., 1937, **97**, 197—207).—Design, scope, and performance are described of an inexpensive 3-w. gas tube with a Cu foil (10 μ.) anode and hemispherical cathode. In single crystal analysis, planes are reflected on the plate by the conical beam as hyperbolæ. Simple analytical technique is developed and exemplified with gypsum. I. McA.

Application of the spectroscope to quantitative analysis. (Simplified spectrocolorimeter.) K. A. SNESAREV and F. M. SCHEMJAKIN (J. Gen. Chem. Russ., 1937, **7**, 1811—1818).—The concn. of coloured salts is determined spectrophotometrically, using apparatus of simple construction. R. T.

Objective colorimeter for the measurement of small colorations and turbidities. H. DREYER (Ann. Physik, 1937, [v], **30**, 650—664).—Apparatus for photo-electric colorimetry with accuracy 0·3—0·5% for aq. solutions containing 0·1 to 0·5 g. of methylene-blue per cu. m. is described. O. D. S.

Apparatus for the subjective study of colour mixtures. V. H. PAVLOVIĆ (Compt. rend., 1937, **205**, 791—792; cf. *ibid.*, **204**, 1635).—A stroboscopic method of colour mixture is described. R. S. B.

Orthostereoscopic photomicrography and some applications. L. C. MARTIN and T. R. WILKINS (J. Opt. Soc. Amer., 1937, **27**, 340—349).—Apparatus for the stereoscopic photomicrography of tracks of α-rays and other high-energy at. particles is described. The conditions for obtaining a natural perspective from photographs made with a compound microscope system are discussed. The position of the stops is also considered. The theory is verified experimentally with both low- and high-power systems. A. J. M.

Photomicrography in chemistry. Photomicrographic reproduction of microchemical crystal precipitations. S. OEHLINGER (Phot. u. Forsch., 1936, **5**, 161—167; Chem. Zentr., 1936, i, 4331).—The utilisation of standard photographic apparatus is outlined. J. S. A.

Refractive indices at low temperatures. A. V. GROSSE (J. Amer. Chem. Soc., 1937, **59**, 2739—2741).—Procedure for determining n with the Abbé refractometer at temp. down to −50° is described. Data are recorded for several org. compounds at low temp. E. S. H.

Application of the fluorescence microscope in analytical chemistry. M. SERVIONE (Ann. Chim. Analyt., 1937, [iii], **19**, 313—319).—The advantages of microscopical fluorescence analysis for microchemical work are indicated. J. S. A.

Precision, all-purpose microcamera. L. C. GRATON and E. B. DANE, jun. (J. Opt. Soc. Amer., 1937, **27**, 355—376).—A new type, high-precision instrument, for photography with transmitted or reflected light, is described. A motor-driven fine focussing mechanism is 100 times slower than on standard instruments. 1 scale division = 100 A. Results indicate that true depth of focus is <, and resolution >, that allowed by current theory. A revision of microscopical theory is suggested since lenses surpass their theoretical limits. N. M. B.

Light counter with positive wall potential. H. PUPKE (Z. tech. Physik, 1937, **18**, 326—332).—The light-sensitivity of counter tubes with positive wall potential is not const. O. D. S.

Water vapour in the construction of more sensitive photo-electric cells of alkali metals. J. KUNZ, J. T. TYKOCINER, and L. P. GARNER (J. Opt. Soc. Amer., 1937, **27**, 354). A. J. M.

High-vacuum multiplate camera. D. A. RICHARDS and R. A. M. BOUND (J. Sci. Instr., 1937, **14**, 402—406).—The apparatus described enables several exposures to be made in an electron diffraction camera or a cathode-ray oscillograph without breaking the vac. in order to remove the photographic plates. L. S. T.

Glass-enclosed metallic reference electrode. O. J. STEWART and W. L. CARRUTH (Ind. Eng. Chem. [Anal.], 1937, **9**, 581—582).—A Hg-filled glass electrode suitable as a reference electrode in oxidation–reduction potentiometric titrations on a semi-micro-scale is described. L. S. T.

Asbestos–potassium chloride bridge and a simple calomel electrode. C. E. ZOBELL and S. C. RITTENBERG (Science, 1937, **86**, 502). L. S. T.

Remote p_H recorder with glass electrode. ANON. (Paper Trade J., 1937, **105**, TAPPI Sect., 332).—The model described is fitted with an automatic sampler, the frequency of sampling being variable at will. The recorder may be 500 ft. from the electrodes, and is very simple in design. The chart is a flat sheet, and the recording pen operates in such a way that back-lash and other mechanical errors are avoided. Processing valves may be made to operate by the instrument, thus permitting automatic control of p_H. H. A. H.

Electrode for electrometric measurement of p_H. P. NYLÉN (Z. Elektrochem., 1937, **43**, 921—923).—Cf. A., 1937, I, 49. J. W. S.

Hot-cathode demountable *X*-ray tube and vapour trap. P. M. HARRIS (Rev. Sci. Instr., 1937, [ii], **8**, 478—480). L. S. T.

Arrangement for investigation of fluorescent materials for cathode-ray tubes. M. VON ARD-

ENNE (Angew. Chem., 1937, **50**, 905—906).—An apparatus for the spectrophotometry of fluorescence phenomena is described. J. S. A.

Application of electron lens to cloud chamber photography. W. T. DAVIES and C. O'CEALLAIGH (Proc. Camb. Phil. Soc., 1937, **33**, 540—548).—The magnetic lens electron focussing system of Busch (Arch. Elektrotech., 1927, **18**, 583) has been adapted to focus high-energy electrons from radioactive sources as they enter the cloud chamber. The dispersion is greatest for particles of lowest energy and these may be removed from the beam by means of stops. The γ-radiation from the source is adequately screened and the stray field within the chamber is negligible. Sources of the order of 10 millicuries must be employed. J. A. D.

Cloud chamber for nuclear disintegration studies. H. R. CRANE (Rev. Sci. Instr., 1937, [ii], **8**, 440—444).—The construction of a purely automatic cloud chamber adapted to the study of of the high-energy electrons produced in artificial disintegration experiments is described. F. J. L.

Apparatus for low-voltage nuclear research. L. J. HAWORTH, L. D. P. KING, C. T. ZAHN, and N. P. HEYDENBURG (Rev. Sci. Instr., 1937, [ii], **8**, 486—493).—The apparatus described gives steady, well-focussed proton beams of 12, 40, and 60 μA. up to energies slightly > 300 kv., and up to 150 and 100 kv., respectively. L. S. T.

Simple electrodialyser. D. B. ROXBURGH and M. H. POWER (Ind. Eng. Chem. [Anal.], 1937, **9**, 578).—With the apparatus described a dialysed Na_2SO_4 solution of protein could be electrodialysed in 6—8 hr. at 220 v. to the point at which the sp. conductivity was $\sim 1 \times 10^{-5}$. L. S. T.

A.c. method of measuring resistance. D. SHOENBERG (Proc. Camb. Phil. Soc., 1937, **33**, 577—582).—The experimental arrangement previously described (cf. A., 1938, I, 19) is used to measure the sp. resistance of high-conductivity metals and to test for superconductivity. The specimen need not be altered from the form in which it is available. Pure specimens of Os, Ge, Mo, and La were examined at liquid He temp. La was superconducting at 4·2 K. At 2·3 K. it was still superconducting at 1500 gauss (cf. Mendelssohn and Daunt, A., 1937, I, 229). No new superconductors were found. J. A. D.

Battery-operated Geiger-Müller counter for the location of lost radium. R. B. TAFT (Rev. Sci. Instr., 1937, [ii], **8**, 508).—The portable instrument described will detect 20 mg. of Ra approx. 135 ft. away when no obstructions intervene. L. S. T.

Evaluation of counter tube measurements. J. MEIXNER (Ann. Physik, 1937, [v], **30**, 665—682).—Theoretical. O. D. S.

"Scale of two" high-speed counter using hard vacuum triodes. W. B. LEWIS (Proc. Camb. Phil. Soc., 1937, **33**, 549—558).—A high-speed recording counter operating on the "scale of two" principle (Wynn-Williams, A., 1932, 671) employs thyratrons only in the output stage. Two triodes are arranged in a symmetrical circuit which is triggered alternately from one stable state to the other by the applied impulses acting through two Cu_2O rectifiers and an inductance. The counter will operate at 20,000 impulses per sec. provided that the recording meter operates in < 0·01 sec. J. A. D.

Determination of dipole moments of solutions. H. MOHLER (Helv. Chim. Acta, 1937, **20**, 1447—1457).—Apparatus and procedure for measuring dipole moments in hexane solutions are described. F. L. U.

Method for magnetic spectrograph calculations. F. T. ROGERS, jun. (Rev. Sci. Instr., 1937, [ii], **8**, 432—436).—A general method for calculating the kinetic energies of charged particles from magnetic spectrograph data, when the magnetic fields used are not uniform, is presented. F. J. L.

Automatic pipette, and a convenient siphon. K. NOWAK (Przemysł Chem., 1937, **21**, 238—239).—Apparatus is described. R. T.

Use of Haldane apparatus for analysis of gases containing ether.—See A., III, 162.

Portable apparatus for precise gas analysis.—See B., 1938, 14.

Dilatometer for high temperatures. S. PYK, B. STÅLHANE, and T. WESTBERG (Jernkont. Ann., 1935, **119**, 401—411; Chem. Zentr., 1936, i, 4184).—An instrument suitable for use with ceramics and metals is described. H. N. R.

High-vacuum leak. W. BOGG (J. Sci. Instr., 1937, **14**, 412—413).—The new design obviates damage by overscrewing to the needle or the orifice that it closes. L. S. T.

Measuring and making visible air currents. U. SCHMIESCHEK (Z. tech. Physik, 1936, **17**, 98—100; Chem. Zentr., 1936, i, 4185).—The production of flocculent smokes from polymerised MeCHO, and their application to the photographic study of air currents, are discussed. J. S. A.

Apparatus for measurement of viscosity coefficients at low temperatures. M. MAKOWIECKA (Acta phys. polon., **2**, 371—374; Chem. Zentr., 1936, i, 4184).—A capillary viscosimeter adapted to liquid air cooling is described. η is determined for fluorocyclene. H. N. R.

Simple Knudsen gauge. A. L. HUGHES (Rev. Sci. Instr., 1937, [ii], **8**, 409—412).—A simple Knudsen pressure gauge consists of a heater (Pt foil) parallel to a piece of Al foil; the deflexion of the Al foil, $\propto$ to the no. of excited gas mols. bombarding it, *i.e.*, to the gas pressure, is measured by means of a microscope. The sensitivity can be varied by altering the temp. of the heater. The upper limit of pressure is 0·01 mm. F. J. L.

Simplified hydrogen liquefier. J. E. AHLBERG, I. ESTERMANN, and W. O. LUNDBERG (Rev. Sci. Instr., 1937, [ii], **8**, 422—426).—A small H_2 liquefier with an efficiency of 16%, using a twisted tube heat interchanger, is described. F. J. L.

Sedimentation equilibrium of sucrose in the simplest opaque air-driven spinning tops as

ultracentrifuges. J. W. McBain and C. Alvarez-Tostado (J. Amer. Chem. Soc., 1937, **59**, 2489—2494).—Two methods for measuring sedimentation equilibrium in a mechanically immobilised liquid are described. In the first, the liquid is immobilised by means of insol. fibres of soap curd; sedimentation takes place in the interstices, and successive portions of the curd are finally removed for analysis. The second method, which is universally applicable to solutions or monodisperse particles, makes use of a simple, opaque, two-piece steel rotor, where the contents are directly accessible for chemical, physical, or biological analysis. E. S. H.

Quantity heads for the air-driven ultracentrifuge. R. W. G. Wyckoff and J. B. Lagsdin (Rev. Sci. Instr., 1937, [ii], **8**, 427—429).—The design and explosion limits of quantity heads capable of centrifuging 100—150 c.c. of liquid in fields of 200,000 to 300,000 g are given. The optimum tube angle is 25°. F. J. L.

Evaporation of quartz in silver. H. W. Edwards (Rev. Sci. Instr., 1937, [ii], **8**, 451—452).—The heater element for the evaporation of quartz on to Ag mirrors is a small Ta V-shaped trough. The temp. of the heater is 1900°, and the reflecting power of the resulting mirror is about 1—2% < that of the freshly deposited Ag. F. J. L.

Deposit of films of uniform thickness for interferometer mirrors. R. A. Fisher and J. R. Platt (Rev. Sci. Instr., 1937, [ii], **8**, 505—507).—The uniformity of evaporated films is discussed, and an apparatus for producing metal films of uniform thickness by evaporation in a vac. is described. L. S. T.

Determination of compressibilities of gases and vapours. K. L. Ramaswamy (Current Sci., 1937, **6**, 214).—Compressibilities can be obtained by determining the pressures corresponding with known vals. of n, referred to a gas such as CH_4 for which vals. of n for various pressures are known. L. S. T.

Charcoal trap for oil vapours. P. A. Anderson (Rev. Sci. Instr., 1937, [ii], **8**, 493—495).—The C mass acts as its own heater as in a granular C resistance furnace. The preliminary baking period for outgassing is much reduced in comparison with C traps heated externally. L. S. T.

Lubrication of taps with phosphoric acids. D. L. Chapman and L. A. Moignard (J.C.S., 1937, 1936—1938).—A new tap, of Hg-sealed type, and the prep. of the lubricant from fused HPO_3 are described. C. R. H.

Technique of preparing collodion membranes. H. Lodenkamper (Zentr. Bakt. Par., 1937, I, **139**, 214—224). L. D. G.

Shaking machine. H. Kühne and A. Bellmann (Chem.-Ztg., 1937, **61**, 994).—The usual form of laboratory shaker (150—360 motions per min.) is mounted, with its motor, on a platform which is subjected to a rocking motion of much lower frequency (2—4 motions per min.). The machine is claimed to be particularly suitable for use with very viscous liquids. J. W. S.

Apparatus for demonstrating the type, water/oil or oil/water, of emulsions. W. J. Pullar (Pharm. J., 1938, **140**, 7).—A procedure similar to that of Bhatnagar (J.C.S., 1920, **117**, 542) is described. The apparatus measures the conductivity of the continuous phase and the increase which occurs when the emulsion changes from oil-in-water to water-in-oil type. W. McC.

Distilling apparatus. J. Erdös and B. Molnár (Tech. Kurir, 1937, **8**, 96).—A combined apparatus for refluxing and distilling is described. E. P.

Ball packings for laboratory rectifying columns. A. R. Glasgow, jun., and S. T. Schicktanz (J. Res. Nat. Bur. Stand., 1937, **19**, 593—603).—The relationships between the efficiency (η), liquid hold-up (v), ball diameter (d), and total surface area (a) have been investigated for fractionating columns packed with glass balls (d = 2·95 and 3·80 mm.), Pb balls (d = 2·05 and 4·05 mm.), and Cu balls (d = 4·00 mm.). For a column of diameter 2·6 cm. packed with such balls the thermal conductivity of the balls is without effect, and, approx., $\eta \propto a/d^2$ and $v \propto a$. J. W. S.

Molecular distillation.—See B., 1938, 2, 3.

Distillation apparatus.—See B., 1938, 3.

M.p. determination. F. Grégoire (Bull. Sci. pharmacol., 1935, **42**, 655—657; Chem. Zentr., 1936, i, 4764).—A method suitable for determining the temp. of initial and of final melting for materials of indefinite m.p. is described. H. N. R.

Apparatus for f.p. determinations. D. Quiggle, C. O. Tongberg, and E. M. Fry (Ind. Eng. Chem. [Anal.], 1937, **9**, 579—581).—The apparatus described is suitable for determining the purity of substances, particularly those freezing at low temp. Results for $CH_2Pr^{\beta}Bu^{\gamma}$ alone and containing 0·9 mol. % of n-C_7H_{16} are given in illustration. L. S. T.

Logarithmic titration graph. E. J. Schorn (Pharm. J., 1938, **140**, 7).—In volumetric determinations depending on neutralisation of ionic charges the p_H is plotted against the $\log_{10}$ of the no. of drops of solution added before and after the end-point is attained. Two parallel straight lines which meet the y-axis are obtained, the distance between the lines representing the p_H change which occurs between the addition of one drop before and one drop after the end-point is reached. The graphs illustrate many points in the theory of the determinations. W. McC.

Significance and function of the history of chemistry. E. Pietsch (Angew. Chem., 1937, **50**, 939—948).—A lecture. L. S. T.

Geochemistry.

Coefficients of absorption and the mean temperature of the atmospheric ozone. G. DÉJARDIN, A. ARNULF, and D. CAVASSILAS (Compt. rend., 1937, **205**, 809—811).—The thickness of the O_3 layer in the atm., reduced to normal temp. and pressure, has been determined as 0·290 cm. ±5% from measurements of absorption in the region 3135—3326 A., and the no. of mols. per c.c. under normal conditions as $2{\cdot}90 \times 10^{19}$. The absorption coeff. of atm. O_3 has been compared with that of laboratory O_3. The mean temp. of atm. O_3 is −35°. R. S. B.

Concentration of D_2O in natural ice. IV. E. BARONI and A. FINK (Monatsh., 1937, **71**, 128—130; cf. A., 1935, 953; 1936, 183, 699).—The $[D_2O]$ in freshly fallen snow, initially 40% < in ordinary H_2O, increases during periods of snowfall, and may become 15% > in ordinary H_2O. This is attributed to fractional pptn. It is concluded that the $[D_2O]$ in atm. H_2O is 25% < in ordinary H_2O (cf. A., 1937, I, 203). J. W. S.

Composition of (A) sea ice, (B) the ice of the Caspian Sea. V. S. KRASNOVA (J. Gen. Chem. Russ., 1937, **7**, 1742—1746, 1747—1748).—Analytical data are recorded for White Sea and Caspian Sea ice. The salt content is highest in the lowest layers of ice, but is considerably < in the underlying H_2O. R. T.

Oxidation-reduction potential in sea-water. L. H. N. COOPER (J. Marine Biol. Assoc., 1937, **22**, 167—176).—Vals. for the standard O_2 electrode potential at various temp. and for the activity of O_2, OH′, and H_2O in sea-H_2O are calc. The theoretical oxidation-reduction potential of sea-H_2O due to a reversible O_2 system is calc. as 0·7—0·8 v. Vals. for the oxidation-reduction potential of sea-H_2O [by W. R. G. ATKINS] and irreversible potentials calc. from Hoar's (1931) results with a Pt electrode show that the oxidation-reduction potential in sea-H_2O is determined by an irreversible O_2 system. The val. at p_H 8·15 was about 0·43 v. The O_2 system in sea-H_2O can never function strictly reversibly. The biologically effective potential may be anywhere between 0·43 and 0·75 v. A. D. H.

Colloidal ferric hydroxide in sea-water. H. W. HARVEY (J. Marine Biol. Assoc., 1937, **22**, 221—225).—Colloidal $Fe(OH)_3$ flocculates in sea-H_2O, the rate increasing with the concn. Protection is afforded by emulsoids such as gum arabic, starch, albumin, and agar. Since 1 mol. of emulsoid protects many mols. of $Fe(OH)_3$ the phenomenon cannot be explained by the shell theory of protection. In the sea it is probable that $Fe(OH)_3$ is also adsorbed on protective emulsoids. In view of the possibility that such compounds may be important in the sea the properties of Fe humates are briefly described. The particles of $Fe(OH)_3$ sol at p_H about 7·4 are positively charged, but adsorption on gum arabic, albumin, or agar caused change in polarity. A. D. H.

Ratio of nitrogen to phosphorus in the sea. L. H. N. COOPER (J. Marine Biol. Assoc., 1937, **22**, 177—182).—It is confirmed that the ratio of NO_3-N to PO_4-P does not vary greatly in sea-H_2O and (as mg.-atoms) is usually about 20. In plankton the N : P ratio is more variable but averages 16·3. The hydrographical importance of the ratio is discussed with particular reference to the English Channel, the Mediterranean, and the South Atlantic. A. D. H.

Nitrogen cycle in the sea. L. H. N. COOPER (J. Marine Biol. Assoc., 1937, **22**, 183—204).—A review. Methylamines and $CO(NH_2)_2$ must be set free in sea-H_2O in considerable quantities as excretory products of animals. The former will be included when NH_3 is determined by distillation. The conditions in sea-H_2O favour the decomp. of $CO(NH_2)_2$ into NH_4CNO, which is hydrolysed to NH_3 and CO_2. A purely chemical mechanism is probably sufficient to account for the hydrolysis of $CO(NH_2)_2$ although bacterial enzymes probably assist. NH_2-acids may be present. They may be of val. to phytoplankton organisms as accessory nutrient substances. The mechanism by which they are assimilated probably differs from that for inorg. N because they must be mainly in the form of zwitterions. N-fixing bacteria are present in the sea and N-fixation by electric discharge also occurs. The production of NH_3 from NH_2-acids and methylamines is probably bacterial. NH_3 is utilised by diatoms, probably as NH_4^+. NH_3 in the sea is oxidised to NO_2'; evidence is adduced for the intermediate formation of hyponitrite. From the surface to about 1 m. depth photochemical oxidation takes place, colloidal SiO_2 possibly being important as a photosensitiser. Chemical oxidation may occur at the surface and may be accelerated by the presence of air bubbles just below the surface. Near the bottom the oxidation is probably bacterial. The mechanism of oxidation of NH_3 in mid-water is unknown. NO_2' is oxidised to NO_3' in the sea; near the bottom bacterial oxidation occurs but in mid-water the mechanism is unknown. Reduction of NO_3' to NO_2' can take place in aërated sea-H_2O even in the absence of denitrifying bacteria, which are known to occur in the sea. The thermodynamic efficiency of the oxidation of glucose by NO_2' and by O_2 is similar. Bacteria may obtain energy both from oxidation of NO_2' to NO_3' and from reduction of NO_3' to NO_2' in presence of org. substances. Photochemical reduction of NO_3' is not possible in the sea. A. D. H.

Origin of calcium hydrogen carbonate contained in the waters of the Versoix (Geneva canton). J. P. BUFFLE (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 77—80; cf. A., 1935, 600).—The presence of $Ca(HCO_3)_2$ is due to the infiltration of surface H_2O containing H_2CO_3, which causes dissolution of $CaCO_3$ in the river bed. A. J. E. W.

[Mineral] water of S. Genesio (Turin). F. BIGLIETTI (Annali Chim. Appl., 1937, **27**, 457—472).—Data for chemical composition, physico-chemical consts., and nature of the dissolved gases are tabulated. F. O. H.

Physico-chemical characteristics of regions of salt domes in Stalingrad region and Kal-

mückia. V. I. Nikolaev, O. K. Janateva, and V. D. Poljakov (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 857—869).—Determination of K' and Br' in the H_2O of springs in the Kalmückian steppes has indicated the presence of deposits of K and Br salts. Analysis of salts extracted from materials from bore-holes in the region of a supposed salt-dome in the Stalingrad region has shown that with increasing depth the concns. of K, Br, and B_2O_3 increase from vals. characteristic of deposits from the Caspian Sea to vals. characteristic of deposits from the Permian Sea. R. C.

Boron content of sea-water and of marine organisms. I. Igelsrud, T. G. Thompson, and B. M. G. Zwicker (Amer. J. Sci., 1937, [v], **35**, 47—63).—B, as sol. borate, has been determined in numerous samples of sea-H_2O from the coastal waters of the north-east Pacific Ocean, and the B–chlorinity ratios calc. The vals. vary from 0·125 to 0·485 mg.-atom of B per kg. of H_2O, and approx. ∝ the chlorinity of the H_2O. The average B–chlorinity ratio (mg. atoms of B per g. of halide) is 0·0223. The presence of complex B compounds may account for the discrepancy between the vals. reported in the literature for B in sea-H_2O. Five species of marine algæ gave 4·2 to 14·9 mg.-atoms of B per kg. of dried material or 15·1 to 50·3 mg.-atoms per kg. of ash. No accumulation of B beyond that observed in terrestrial plants growing in good soils low in B was observed in the species of marine plants examined. 20·8 and 80·0 mg.-atoms of B per kg. were found in the marine animal shells of *Conus* and *Cyprea*, and 173 mg.-atoms per kg. in a sample of *Hydrocorallina*, indicating that B may occur generally in calcareous and sedimentary structures of oceanic origin, probably as Mg or Ca borates. L. S. T.

Thermal water in Bukovička Banja. S. Miholić (Bull. Soc. Chim. Yougoslav., 1937, **8**, 83—96).—Analyses are given. F. L. U.

Recent changes in the water of Laguna de Bay and their effect on the lake fauna. S. M. Cendaña and A. M. Mane (Philippine Agric., 1937, **26**, 327—340).—Changes following the influx of sea-H_2O into the lake are recorded. A. G. P.

Hydrochemistry of the Gulf of Karabugaz. V. P. Ilinski, G. S. Klebanov, and J. B. Blumberg (Trudi Solianoi Lab., 1936, No. 5, 9—47).—Complete redissolution of the $Na_2SO_4,10H_2O$ deposits does not take place during the summer months. Part of the Mg is pptd. as $MgCO_3$ by $Ca(HCO_3)_2$ present in Caspian Sea H_2O entering the Gulf. The *d* of the H_2O has risen from 1·136 in 1897 to 1·174 in 1932; the H_2O will be saturated with respect to NaCl in 40—50 years, at the present rate of concn. R. T.

Reduction of sulphates in Caspian Sea water. A. D. Pelsch (Trudi Solianoi Lab., 1936, No. 5, 81—108).—The max. concn. of H_2S tolerated by *Microspira æstuarii*, van Delden, varies according to the p_H, inasmuch as HS' is far less toxic than is H_2S; concns. of >2400 mg. per l. of H_2S are tolerated at p_H 9 (98% dissociation of H_2S), and may be achieved by the action of *Microspira* on sulphates. R. T.

The red lake near Witzenhausen: recent and fossil weathering of felspar-basalt. E. Blanck and R. Themlitz (Chem. Erde, 1937, **11**, 375—407).—The H_2O in an abandoned quarry in basalt with adjoining Bunter sandstone is deep red, and contains colloidal SiO_2, Al_2O_3, and Fe_2O_3. Analyses are given of the fresh and weathered rocks and of bauxitic products of Tertiary age. L. J. S.

Chlorides in chemical weathering and hydrogen-ion concentration in geology. M. Storz (Chem. Erde, 1937, **11**, 408—419).—Limestones on the Dalmatian coast show cavernous weathering due to the action of NaCl on $CaCO_3$ with the formation of Na_2CO_3 and $CaCl_2$. Sea-H_2O standing in rock pools shows a max. p_H value of 8·8—9·0. In artificial sea-H_2O p_H was raised from 6·5 to 8·8 by the addition of $CaCO_3$. L. J. S.

Composition of the mud of the brine of the Karabugaz Gulf. L. S. Selivanov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 455—458).—From analyses of the mud and the associated brine, an attempt is made to deduce the hydro-chemistry of the Gulf. C. R. H.

(A) Dynamics, (B) energetics, of the desulphatation process. A. D. Pelsch (Trudi Solianoi Lab., 1937, No. 14, 5—43, 45—81).—(A) *Vibrio æstuarii* has been identified in the sludge from the Strait of Karabugaz. Its growth is inhibited by limiting concns. of undissociated H_2S, the val. of which depends on the p_H and salt content of the medium.

(B) The mechanism of the microbiological reduction of H_2SO_4 to H_2S is discussed from the thermodynamical point of view, and it is shown that free H_2 is not involved, but that a no. of unknown H donators effect reduction through the stages $H_2SO_4 \rightarrow H_2SO_3 \rightarrow (H_2SO_2) \rightarrow (H_2SO) \rightarrow H_2S$. *Vibrio desulfuricans*, *V. æstuarii*, and *V. thermodesulfuricans* are able to effect only those stages involving diminution of free energy of the system, whilst *V. rubentschickii* can also produce changes leading to increase in free energy (oxido-reduction of glucose). R. T.

(A) Formation of sludge in Lake Moinak. (B) Micro-zonal analysis of sludge deposits. (C) Hydrobiological conditions of sludge formation. J. V. Pervolf (Trudi Solianoi Lab., 1937, No. 14, 83—96, 97—104, 105—119).—(A) Biological conditions are described.

(B) Methods of microscopical examination of mud profiles are described.

(C) Algæ develop in salt lake H_2O of a salt content corresponding with $d < 1·14$, and can enter into the composition of the sludge on condition of periodic overlaying with inorg. detritus. R. T.

Slime of Brazilian mangrove swamps. F. W. Freise (Chem. Erde, 1937, **11**, 333—355).—Mechanical and chemical analyses are given, and alterations in the material are considered. L. J. S.

Geochemistry of lithium. H. W. Strock (Nachr. Ges. wiss. Göttingen, 1936, [ii], **1**, 171—204; Chem. Zentr., 1936, i, 4409—4410).—Li is determined spectrographically, using the 6708 A. line and adding

NaCl to enhance the sensitivity. Analyses of igneous rocks and their differentiation products, zeolites, meteorites, sedimentary rocks, plant ashes, and coals show a mean Li content of 0·014% in igneous rocks. Granites show 100-fold enrichment as compared with Mg-rich rocks, ten-fold as compared with gabbros. Li is progressively enriched in the darker coloured constituents on increasing differentiation, but does not run parallel to other univalent metals, *e.g.*, Na. Li replaces Mg isomorphously in pyroxenes and hornblendes, but the Li_2O : MgO ratio is fairly const. in sedimentary clays. J. S. A.

Optical and spectrographic examination of beryls, especially at high temperatures. R. Böse (Neues Jahrb. Min., 1936, **A**, **70**, Beil.-Bd., 467—570; Chem. Zentr., 1936, i, 4701—4702).—Measurements of *n*, *d*, dispersion, double refraction, and dispersion of double refraction are recorded for beryls from various sources up to 1150°, and the variations in optical properties correlated with increase in *d*. Beryls of low *d* free from inclusions may be heated to 1000°; those of high *d* with inclusions are destroyed above 700°. Li, Na, K, Cs, Ca, Mg, Ga, Sc, Ti, V, Mn, Cr, Fe, Ni, Sn, Cu, and Ag were detected spectroscopically. Emeralds from Katharinenburg have a very high V content, with considerable amounts of Ti and Sc. CO_2, H_2, and H_2O are evolved from beryls on heating at 1200°; He was detected in only one case. The deposit volatilised off in vac. contained Fe, Mn, Ni, Cu, Ag, Ga, Ti, Ce, Na, Mg, and Zn. The deposit from Leydsdorp emerald contained no Cr, which is considered to be combined differently from the other metals; a part of the Fe in aquamarine is similarly differentiated. J. S. A.

Volcanic rocks of Ság Mt., Hungary. L. Jugovics and A. Marchet (Tsch. Min. Petr. Mitt., 1937, **49**, 369—414).—Petrographical descriptions and chemical analyses are given of basalt and dolerite, showing that these rocks belong to the "Atlantic series." L. J. S.

Emerald and associated minerals in the Habach valley, Salzburg. H. Leitmeier (Tsch. Min. Petr. Mitt., 1937, **49**, 245—368).—Emerald occurs in biotite-schist at the junction of gneiss and amphibolite. Analysis, SiO_2 63·54, Al_2O_3 17·25, Cr_2O_3 0·12, Fe_2O_3 0·71, BeO 13·07, MgO 0·84, CaO 0·78, Na_2O 1·42, K_2O 0·14, H_2O 2·97 = 100·84, *d* 2·749, does not correspond with the usually accepted formula $Be_3Al_2Si_6O_{18}$. Variations in *d* and *n* are compared with the data for emerald from other localities. The associated minerals and rocks are described and their origin is discussed. The occurrence is similar to that in the Urals. L. J. S.

Analysis of granite from Montorfano and of granite and tourmaline from Alzo [Italy]. P. Gallitelli (Atti R. Accad. Lincei, 1937, [vi], **26**, 103—106).—Analytical data are tabulated. The granites contain SiO_2 and Al_2O_3 69·52, 70·62, and 15·45, 15·66%, respectively, whilst the tourmaline contains B_2O_3 8·82%. F. O. H.

Textural groups of Wisconsin till and their distribution in Illinois. H. Wascher and E. Winters (Amer. J. Sci., 1937, [v], **35**, 14—21).—Mechanical analyses showing the range in composition of the four textural groups proposed are given. L. S. T.

Density and structure of zircon. II. M. von Stackelberg and K. Chudoba (Z. Krist., 1937, **97**, 252—262; cf. A., 1937, I, 382).—Density and *X*-ray analyses with heat-treatment show that very light zircons, ρ 3·972, 3·945, are oxide decomp. products of $ZrSiO_4$, the SiO_2 being amorphous, the ZrO_2 amorphous or microcryst. On heating these at 1450°, $ZrSiO_4$ is re-formed as a single crystal or fibre structure; above 1000° ρ increases but is $\ll$ the normal 4·7. Discussion of further data of the authors and others on zircons of intermediate ρ reveals difficulties in correlating mechanical, optical, thermal, and *X*-ray results. I. McA.

New form of titanite. H. Meixner (Z. Krist., 1937, **97**, 332—335).—Cryst. features are described. I. McA.

Morphology of apophyllite. J. D. H. Donnay (Bull. Acad. roy. Belg., 1937, [v], **23**, 749—761).—The structure of apophyllite accords with the generalised Bravais law (A., 1937, I, 171). It shows zonal series of the simple primary, double primary, and double secondary types. J. W. S.

Crystallographic investigation of borates of Inder deposit. G. B. Boki (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 871—883).—The crystallographic characteristics and consts. of ulexite, colemanite, inyoite, pandermite, hydroboracite, ascharite, and inderite ($2MgO,3B_2O_3,15H_2O$) are recorded. R. C.

Polymorphic transitions in leucite. J. Wyart (Compt. rend., 1937, **205**, 1077—1079).—Leucite (cf. A., 1937, I, 17) is pseudo-cubic at ordinary temp., being built up of tetragonal crystallites regularly arranged. On heating, the spacings (001) and (100) become more nearly equal, and coincide at 625°. The mineral is then true cubic, but will return to the pseudo-cubic form on cooling. The transition is gradual and continuous, heat being absorbed during heating from 575° to 625° just before the transition. Heat is evolved as the structure returns to normal on cooling. J. A. D.

Anomalies of structure and composition of phosphates of the Paris Basin. L. Cayeux (Compt. rend., 1937, **205**, 1021—1023).—The origin of the minerals has been investigated. Intermediate strata of foreign minerals were observed and the concns. were apparently originally submarine. J. A. D.

Origin of gold in the borders of Guinea and Sudan, and in the ancient Haute-Volta. J. Sagatsky and R. Goloubinow (Compt. rend., 1937, **205**, 925—927). A. J. E. W.

Submarine (halmyrolytic) alteration-skin of Baltic pebbles. K. Hummel (Chem. Erde, 1937, **11**, 356—367).—Pebbles of various rocks dredged from the Baltic show an outer alteration zone a few mm. in thickness. Analyses of the fresh and altered rock show no essential difference from terrestrial weathering. L. J. S.

Presence and distribution of boron in the strata of the potassium salt deposits of Alsace. G. BERTRAND (Bull. Soc. chim., 1938, [v], **5**, 69—72).—The layers of clay separating the saline layers contain from 50 to 500 mg. of B per kg. With the exception of the parts nearest to these layers of clay, the saline layers contain only 1 or 2 mg. per kg. F. J. G.

Classification of the natural silicates. I, II. C. K. SWARTZ (Amer. Min., 1937, **22**, 1073—1086, 1161—1174).—I. The classification proposed is based on the four ways in which the SiO_4 tetrahedra can combine through their solid angles. The five fundamental types may combine further to form complex types. The relationship of this classification to earlier classifications is discussed.

II. Compositions as determined by *X*-ray analysis are tabulated according to the proposed classification. L. S. T.

Unit cell and space-group of cubanite. M. J. BUERGER (Amer. Min., 1937, **22**, 1117—1120; cf. A., 1936, 585).—A Weissenberg study of cubanite from Sudbury gives *a* 6·43, *b* 11·04, *c* 6·19 A., with 4 $CuFe_2S_3$ per cell; space-group *Pna* or *Pcmn*. The chemical analysis indicates an excess of Fe over that required by $CuFe_2S_3$. This is balanced by a deficit of Cu. L. S. T.

Riebeckite in quartz veins from the Michipicoten district, Ontario. J. E. HAWLEY (Amer. Min., 1937, **22**, 1099—1103).—The occurrence of fibrous riebeckite in quartz veins and in granitic and basic volcanic wall rocks in this area is described. L. S. T.

Origin of Pelvoux granite. P. BELLAIR (Compt. rend., 1938, **206**, 189—190). A. J. E. W.

Selective incrustation of minerals. C. FRONDEL (Amer. Min., 1937, **22**, 1104—1116).—Examples of selective incrustation are described and tabulated, and the origin of the selectivity is discussed. Crystallisation of one mineral on another is closely connected with adsorption at the crystal–solution interface. Chemical reaction between a solution or a sol and the surface of the incrusted crystal may also effect selectivity. Minerals that are identical or nearly so in crystal structure, *e.g.*, members of the calcite group, the felspars, and sphalerite-tetrahedrite-chalcopyrite, have a marked tendency to incrust each other in preference to other species. L. S. T.

Origin of montmorillonite. W. H. TOMLINSON and A. E. MEIER (Amer. Min., 1937, **22**, 1124—1127). L. S. T.

Coloration of minerals. A. E. FERSMAN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 201—204).—The deepening of the colour of a crystal when ions of one of its elements, but in a different state of valency or ionisation, enter the lattice is attributed to the indefinite state of the valency electrons on the boundary between the two ions. The phenomenon is observed in minerals containing $Fe^{II} + Fe^{III}$, $Mn^{II} + Mn^{III}$, $Co^{II} + Co^{III}$, $U^{IV} + U^{V}$, and $V^{IV} + V^{V}$, which in some cases are black. Various pigments, *e.g.*, W-blue ($WO_3 + WO_2$), are of this type, and even Prussian-blue and Turnbull's blue can be placed in the same class. J. W. S.

Nature of the zircon deposit of Mount Ampanobe, Madagascar. A. LACROIX (Compt. rend., 1937, **205**, 1333—1336).—The geology of the region and the origin of the zircon deposit are discussed. A. J. E. W.

Pencatite from the Organ mountains, New Mexico. W. F. HUNT and G. T. FAUST (Amer. Min., 1937, **22**, 1151).—The results of a petrological and chemical examination of a dedolomitised rock are recorded. L. S. T.

Missouri glauconite. V. T. ALLEN (Amer. Min., 1937, **22**, 1180—1183).—The TiO_2 contents of four glauconites (analyses given) are discussed in relation to their possible origin from biotite. L. S. T.

New locality for autunite. E. S. C. SMITH and E. O. E. MASLOWSKI (Amer. Min., 1937, **22**, 1184).—An occurrence associated with dark smoky quartz at Hooper's Ledge, Maine, is recorded. L. S. T.

New occurrence of millerite [at West Pittston, Pennsylvania]. M. A. NORTHUP (Amer. Min., 1937, **22**, 1184—1185). L. S. T.

Identification of transparent gem stones by their density and colour. K. CHUDOBA (Deut. Goldschmiede-Ztg., 1936, **39**, 90—91; Chem. Zentr., 1936, i, 4189).—Tables are given. J. S. A.

Can graphite be present in Late-Glacial clays? II. A. SALMINEN (Suomen Kem., 1937, **10**, B, 30).—The org. matter in two Finnish Late-Glacial clays is almost completely burnt at 700°, and C therefore cannot be present as graphite, in confirmation of previous work (*ibid.*, 5). M. H. M. A.

Genesis of colloidal metals in salt soils. Gedroitsite, a new mineral. I. N. ANTIPOV-KARATAIEV and I. D. SEDLECKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 251—254).—In order to ascertain the conditions resulting in the formation of colloidal minerals having a high alkali content, experiments on artificial mineral production were made. A gelatinous ppt. formed by mixing pure liquid glass dissolved in NaOH with $NaAlO_3$ was dried, and after 3 years was shown, by the Debye–Scherrer *X*-ray powder method, to have developed a complex cryst. structure. The substance is unchanged when heated to 1020°, and is regarded as a new mineral of high alkali content not removable by H_2O. N. M. B.

Geological basis of the search for oil in Great Britain. G. M. LEES and P. T. COX (Quart. J. Geol. Soc., 1937, **93**, 156—194).—Results obtained in recent drillings are also described. L. S. T.

Coal in glacio-fluvial deposits in Ohio. K. VER STEEG (Science, 1937, **86**, 285—286).—The widespread occurrence of waterworn fragments of coal in sand and silt deposits near Conotton Creek, Ohio, is described. L. S. T.

Coal measures of Bristol and Somerset. L. R. MOORE and A. E. TRUEMAN (Quart. J. Geol. Soc., 1937, **93**, 195—240). L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MARCH, 1938.

BIBLIOTHEK

Spectrum of the hydrogen flame. V. KONDRATEEV and M. ZISKIN (J. Phys. Chem. Russ., 1937, **10**, 360—366; cf. A., 1937, I, 493).—One activated mol. of OH is formed for overy 10^6 mols. of H_2O. J. J. B.

Spectrum of the arc in hydrogen. R. W. WOOD and G. H. DIEKE (Physical Rev., 1938, [ii], **53**, 146—152).—The spectrum of the arc-like discharge in H_2 and HD at about 50 cm. and 1 amp. in a special form of discharge tube was photographed with a 15-ft. grating and compared with the ordinary vac. discharge spectrum. Differences are discussed and explained. N. M. B.

Equilibrium in electrodeless discharge. I. Disappearance of hydrogen in electrodeless discharge. II. Electrodeless discharge through water vapour and silane. III. Electrodeless discharge through oxygen. IV. Electrodeless discharge through carbon dioxide. N. B. BHATT and S. K. K. JATKAR (J. Indian Inst. Sci., 1937, **20**, A, 25—33, 34—42, 43—45, 46—48).—I. The rate of disappearance of H_2 depends on the previous history of the degassed Pyrex tube and the input of the oscillator used for the discharge. A fatigue effect is observed.

II. By removing the condensiblo products formed in the above discharge, the H_2 is found to be adsorbed in a unimol. layer in a quartz tube and a multimol. layer in a Pyrex tube. Further loss of gas is due to formation of H_2O vapour, which is itself 70% dissociated by the action of the discharge. No Si hydride could be detected; SiH_4 introduced in the discharge tube decomposed into Si and H_2.

III. The quantity of O_2 adsorbed corresponds with the formation of a unimol. layer in a quartz tube. No O_3 could be detected.

IV. CO_2 at 0·185 mm. is 25% dissociated in an electrodeless discharge and about 70% in the presence of 0·0725 mm. H_2. D. F. R.

Spectrum of H_2 from 4225 to 4756 A. N. A. KENT and R. G. LACOUNT (Astrophys. J., 1937, **86**, 311—320; cf. A., 1937, I, 157).—$\lambda\lambda$ of 435 lines, measured with a 21-ft. concave grating, are compared with those given by former investigators. L. S. T.

Gas discharge at low- and high-frequency alternating discharge. H. J. LINDENHOVIUS (Physica, 1937, **4**, 1212—1223).—The first appearance of luminous discharge, and its reappearance in Ne, are investigated at low frequency (0—10^4 Hertz) and at high frequency (10^5—10^7 Hertz). The effect of pressure, potential, and resistance is observed and discussed theoretically. F. J. L.

Zeeman effect of the p^5d configurations of neon and argon. J. B. GREEN, J. A. PEOPLES, jun., and B. FRIED (Physical Rev., 1938, [ii], **53**, 105).—Preliminary resolution of configurations to allow the determination of g factors gives results in good agreement with available data. N. M. B.

Rotational analysis of the visible O_2^+ bands. T. E. NEVIN (Nature, 1937, **140**, 1101).—Details of the structure of these bands obtained by a heavy discharge through He containing a small amount of O_2 are recorded. Preliminary vals. for the mol. consts. are given. L. S. T.

Effect of current density on ionisation processes in the spontaneous discharge in the inert gases. R. SCHADE (Physikal. Z., 1937, **38**, 1021—1024).—The falling characteristic and lowering of spark potential of pure inert gases on irradiation cannot be explained as due to a space-charge effect. It is due to an ionisation process which depends on the square of the c.d. The process is probably one of ionisation by collision of two metastable atoms. When small amounts of other inert gases are added the life period of the metastable atoms is considerably reduced. The addition of small quantities of Hg to A or of A to Ne reduces the slope of the characteristic considerably. The glow discharge is also affected by c.d. A. J. M.

Predissociation of sulphur. F. OLSSON (Z. Physik, 1938, **108**, 40—44).—The absorption band, λ 2799, of S_2 shows distinct broadening of the lines. Certain lines of the band at λ 2829 show broadening but all those of the band at λ 2860 are sharp. The limit of predissociation therefore is λ 2829. Lochte-Holtgreven's observations of the effect of pressure on the predissociation region could not be confirmed. H. C. G.

Spectrum of A^+ at $1{\cdot}2 \times 10^{-4}$ Tor pressure. W. VON MEYEREN (Ann. Physik, 1938, [v], **31**, 193—218; cf. A., 1938, I, 109).—Measurements have been made of the intensity distribution in the A^+ spectrum at $1{\cdot}2 \times 10^{-4}$ Tor. Distribution within the multiplets is, for the most part, in agreement with the formula of Sommerfeld, Hönl, and Kronig, even for terms of which the multiplet splitting is not in accordance with pure Russell–Saunders coupling. It was observed that, for doublet transitions with simultaneous alteration of the nuclear configuration, transitions in which the azimuthal quantum no. is unchanged are preferred. O. D. S.

Pressure effects of homogeneous potassium vapour in absorption. D. S. HUGHES and P. E. LLOYD (Physical Rev., 1937, [ii], **52**, 1215—1220).—Using the new corrosion-resistant MgO windows for the absorption cell, the K resonance lines λλ 7664·9, 7699·0 in absorption of a homogeneous vapour were obtained for the pressure range 0·001—20 mm., and contours were investigated. Corresponding half-breadth magnitudes were several times that predicted by the theory of resonance interaction. The infra-red K_2 bands were observed. N. M. B.

Anomalous dispersion measurements on the first doublets of Cu and of Au. L. ALLEGRETTI (Nuovo Cim., 1937, **14**, 337—342).—The ratios of the no. of dispersion electrons for the two lines of the first doublets of Cu and of Au are 2·01 and 2·18, respectively. O. J. W.

Zeeman effect on hyperfine structure components. E. RASMUSSEN (Z. Physik, 1937, **107**, 741—745).—The Zeeman effect with hyperfine structure of the Cd I line, λ 4678, has been examined in a field of 500 oersted. Results confirm Goudsmit's theories regarding hyperfine structure. H. C. G.

Polarisation effects in the electric arc. R. BRECKPOT and C. WEYN (Ann. Soc. Sci. Bruxelles, 1937, **57**, 306—317).—Investigations previously reported (cf. A., 1936, 1082) are extended to the effect of Sb on Sn and Sn on Sb (0·3—3%) in the lines of the Pb–Pb and Pb–graphite arc. Curves for the intensity variations of the lines with concn. of impurity are given and discussed. N. M. B.

Spectrum of the cæsium molecule. W. FINKELNBURG and O. T. HAHN (Physikal. Z., 1938, **39**, 98—100).—118 absorption bands in the infra-red between 11,292 and 9077 A. have been measured. The bands show a definite structure, the width being too great for true rotational structure. In the emission spectrum, in addition to broadened lines, three diffuse bands with max. at 7187, 7127, and 7060 A. were found, of which the intensity increases much more rapidly than that of the lines with increasing v.p. They occur also in the absorption spectrum. Comparison of vibrational quanta of the alkali-metal mols. shows that the quotient of these for two electronic states is approx. const. for all these metals. The nuclear separation, r, for Cs_2 is 4·55 A., the moment of inertia, I_0, is 2270×10^{-40} g.cm.^{2}, and the rotational const. B_0 is 0·012 cm.$^{-1}$ These were calc. by Badger's equation (A., 1934, 477), which also gives for Rb_2, $r = 4{\cdot}23$ A., $I_0 = 1260 \times 10^{40}$ g.cm.^{2}, and $B_0 = 0{\cdot}022$. A. J. M.

Spark spectra of cæsium. R. RICARD, (MLLE.) M. GIVORD, and (MLLE.) F. GEORGE (Compt. rend., 1937, **205**, 1229—1230; cf. A., 1925, ii, 451; 1933, 200).—The spectrum of an electrodeless discharge in Cs vapour, between 6000 and 900 A., has been photographed. Three groups of lines, distinguished by the necessary exciting potentials, are observed; the first consists of the arc spectrum, and the second of the spectrum of Cs II, a classification of the principal lines of which is given. λλ of the chief lines in the third group, between 2400 and 2000 A., are given. A. J. E. W.

First spark spectrum of cerium, Ce II. W. E. ALBERTSON and G. R. HARRISON (Physical Rev., 1937, [ii], **52**, 1209—1215).—By applying the spectral interval sorter (cf. A., 1934, 51) and a new interval recorder to new data obtained with the automatic recording spectrum comparator a preliminary term analysis for the range 5000—2850 A., accounting for 584 lines as transitions between 31 lower and 51 upper states, is tabulated. The analysis due to Haspas (cf. A., 1936, 128) is not supported. Calc. and observed wave no. differences are in close agreement. Several assignments were checked with partly resolved Zeeman patterns and abs. J vals. were determined. N. M. B.

Arc and spark spectra of ytterbium. W. F. MEGGERS and B. F. SCRIBNER (J. Res. Nat. Bur. Stand., 1937, **19**, 651—664).—λλ and intensities are recorded for 1668 lines, 400 due to Yb, 1250 due to Yb^+, and a few possibly due to Yb^{++}. The ground states of the Yb, Yb^+, and Yb^{++} atoms are probably associated with the $4f^{14}6s^2$, $4f^{14}6s$, and $4f^{14}$ electron configurations, respectively. J. W. S.

Spectrum of doubly ionised mercury, Hg III. M. W. JOHNS (Canad. J. Res., 1937, **15**, **A**, 193—201).—The spectrum of Hg has been measured from λ 400 to 11,000 A., and the analysis of Hg III is extended to include 77 new and 7 unidentified terms. Isotope shifts have been observed in 11 lines, confirming their classification. D. F. R.

Pressure effects on spectral lines. H. MARGENAU and W. W. WATSON (Rev. Mod. Phys., 1936, **8**, 22—53).—A review. CH. ABS. (*e*)

Characteristics of the electric arc. A. KOTECKI (Acta phys. polon., 1935, **4**, 113—122; Chem. Zentr., 1936, i, 4404).—Current–voltage characteristics are discussed with particular reference to the effect of the electrode materials. J. S. A.

Measurements of the spectral intensity of the radiation standard lamp of Krefft, Rössler, and Rüttenauer in the ultra-violet. E. FISCHER (Z. tech. Physik, 1937, **18**, 336—342).—Further tests confirm the constancy of spectral distribution in the standard lamp of Krefft *et al.* Relative intensities from 4358 to 2483 A. are tabulated. O. D. S.

Initiation [of glow discharge] and voltage change of initiation. W. ROGOWSKI and A. WALLRAFF (Z. Physik, 1938, **108**, 1—18).—The initiation of a glow discharge and the relation between striking voltage, γ-ionisation, and certain secondary effects is examined mathematically with special reference to air, A, and Ne. H. C. G.

Sodium content of the head of the great daylight comet, Skjellerup 1927K. A. ADEL, V. M. SLIPHER, and R. LADENBURG (Astrophys. J., 1937, **86**, 345—362).—Spectrograms show the D-lines of Na in emission with practically equal intensity. L. S. T.

Does iron occur in the Solar corona? (A) A. RUBINOWICZ. (B) F. J. M. STRATTON (Nature, 1938, **141**, 81).—Discussions. L. S. T.

Light of the night sky. J. KAPLAN (Physical Rev., 1937, [ii], **52**, 1252).—Evidence is given that

10 new members of the tail bands in the CN violet $^2\Sigma \rightarrow {}^2\Sigma$ system over λλ 3000—3400, observed in a high-pressure auroral tube, are enhanced analogously to the enhancement of the green sequence of the first positive N_2 group in the auroral glow, and that the night sky excitation produces selectively the tail bands of CN. λλ of the latter in the range 3438—4085 agree closely with unidentified night sky radiations reported by Gauzit (cf. A., 1935, 3). N. M. B.

Double scattering of polarised *X*-rays. P. KIRKPATRICK (Physical Rev., 1937, [ii], **52**, 1201—1209).—Mathematical. Formulæ are given for the intensity of twice scattered *X*-radiation emerging from a scattering body at 90° to an incident beam of arbitrary polarisation. Spherical and cylindrical scatterers (primary radiation incident parallel and normal to the cylinder axis) are treated. N. M. B.

Röntgen interference of self-luminous crystals. H. OTT (Ann. Physik, 1938, [v], 264—288).—Mathematical. A wave-kinematic theory of the Kossel interference (cf. A., 1935, 1306) is developed and its relation to the theory of von Laue (cf. *ibid.*) discussed. O. D. S.

Characteristics of thermo-electronic emission of thoriated molybdenum. P. GRAUWIN (Compt. rend., 1937, **205**, 1375—1377).—The emission of filaments containing 2·6% of Th has been examined. Activation occurs at 1500—1800° K., and has a max. velocity at 1750° K. The filaments deteriorate rapidly on repeated activation and deactivation. The Richardson consts. A and Φ are $1{\cdot}0 \pm 0{\cdot}25$ amp./cm.^{2}-deg.^{2} and $2{\cdot}61 \pm 0{\cdot}01$ ev., respectively. A. J. E. W.

Energy distribution of photo-electrons from sodium. A. G. HILL (Physical Rev., 1938, [ii], **53**, 184—193).—Using the retarding potential method with concentric spherical electrodes, the total energy distribution functions for photo-electrons from evaporated Na surfaces were determined for λλ 6250—2302 A. The discrepancy between results and the theoretical energy distribution curves can be accounted for by assuming a selectively transmitting surface field with a transmission max. at 0·5 e.v. The disagreement of the calc. and experimental spectral distribution function for the image field is only partly corr. by the use of the selective transmission barrier. It is concluded that the frequency dependence of the quantum absorption probability and the energy dependence of the barrier transmission probability differ from the image field predictions, the discrepancy being related to the practical impossibility of producing an "ideal" Na surface. N. M. B.

Disintegrations caused by electrons of very high energy. J. SOLOMON (Compt. rend., 1937, **205**, 1231—1232).—Theoretical. Calculations of the effective cross-section of an at. nucleus, based on the Bohr and Hartree nuclear models, are compared. A. J. E. W.

Splitting-off of electrons from a magnesium oxide cathode through positive ion rebound in an anomalous glow discharge. A. GÜNTHER-SCHULZE and W. BÄR (Z. Physik, 1937, **107**, 730—740).—Glow discharges were set up between a Fe anode and an oxide-coated electron metal (= MgO) cathode in a no. of rare gases, H_2, N_2, and O_2. When energy arriving at the cathode, observed calorimetrically, is subtracted from the calc. energy, the difference is simply related to the no. of electrons split off from the cathode surface after positive ion rebound. L. G. G.

Atomic electron velocities. A. L. HUGHES and M. M. MANN, jun. (Physical Rev., 1937, [ii], **53**, 50—63).—It follows from Jauncey's treatment of electronic collisions (cf. A., 1934, 1282) that the energy distribution of fast scattered electrons is identical with the distribution of component velocities of the at. electrons producing the scattering; the latter distribution is identical in shape with the profile of the Compton modified band in *X*-ray scattering. A beam of 1000—4000 v. electrons was directed into He at low pressure and the distribution of energies of electrons scattered at 34·2° was measured. Results gave a profile for the Compton modified band in good agreement with calculation, hence giving a new method of investigating at. electron velocities. N. M. B.

Passage of slow electrons (0—200 v.) through metal foils. H. KATZ (Physikal. Z., 1937, **38**, 981—984).—Thin foils of Ag which were very transparent to slow electrons were prepared. For low primary electron energies the electrons pass through without much loss of energy or change of direction. The higher is the primary energy the smaller is the no. of transmitted electrons which retain their original energies. Considering only those electrons transmitted without loss of energy, there is a max. in the transmission curve, showing that there is a definite energy for which electrons are transmitted by the foil particularly easily. The previous treatment of the foil influences the transmissibility considerably. It is not due to spaces in the foil. A. J. M.

Liberation of secondary electrons in adsorption layers. O. KRENZIEN (Physikal. Z., 1937, **38**, 994). A. J. M.

Secondary electron emission. I. Secondary electron emission of metals. H. BRUINING and J. H. DE BOER (Physica, 1938, **5**, 17—30).—Data are recorded for Li, Ag, Cs, Be, Mg, Ba, Al, and Cu. The electropositive elements have a smaller secondary emission with a primary electron energy of < 100 v. than metals with a high work function. Results to the contrary are due to experimental errors. H. J. E.

Intensity of the principal electronic conversion lines of the active deposit of thoron; photographic efficacy of electrons. R. ARNOULT (Compt. rend., 1937, **205**, 1380—1382).—The β-ray emission spectrum of the deposit has been investigated photographically and with a Geiger–Müller counter; comparison of the results enables the relative blackening of the photographic plate for electrons of different energies to be deduced. The results are in accord with those of Ellis and Aston (A., 1928, 932). A. J. E. W.

Excitation of gases at very low pressures by electron collision. W. VON MEYEREN (Ann.

Physik, 1938, [v], **31**, 164—176; cf. A., 1935, 4).—A method by which spectra of high intensity are excited by electrons in A at low pressure, 1×10^{-4} Tor, is described. O. D. S.

Light-excitation by hydrogen and deuterium positive rays. W. HANLE (Physikal. Z., 1937, **38**, 995—998).—The intensity of light emitted when He and A are excited by electrons, protons, and deuterons depends on the velocity of the particles. For A the intensity is greater when excited by H than by D particles of the same energy, up to a max. The reverse is the case for particles of the same velocity. The intensity–energy and intensity–velocity curves for He and A are compared. The excitation of H and D atoms on collision with He was examined as a function of the kinetic energy of the H and D atoms, and the effect of pressure on the intensity of the H, D, and He lines was investigated. A. J. M.

Recombination of ions in pure oxygen as a function of pressure and temperature. M. E. GARDNER (Physical Rev., 1938, [ii], **53**, 75—83).—The modern technique employed ensured a thoroughly outgassed ionisation chamber prior to the introduction of carefully purified O_2 and elimination of initial recombination. Curves showing the variation of the recombination coeff. α with time at given pressures for 10—76 cm., and with temp. for −78° to 105°, are given, and results are in general agreement with Thomson's, but not with Langevin's, theory. α is const. at a given pressure over extended time intervals; the val. found at 25° and 76 cm. is $2{\cdot}08 \pm 0{\cdot}05 \times 10^{-6}$. The influence of initial recombination and retarded diffusion is discussed with reference to Loeb's treatment. N. M. B.

Large-angle scattering and energy loss of potassium ions scattered by heavy monatomic gases. A. G. ROUSE (Physical Rev., 1937, [ii], **52**, 1238—1244).—A beam of K ions of energy range 90—360 v. was scattered by collision with A, Kr, Xe, and Hg vapour and angular distribution was observed. For slower particles the scattering per unit solid angle relative to the centre of mass of the colliding particles decreases with angle; at higher voltages the scattering increases at larger angles. The scattering at the larger angles increases with voltage. Results are not compatible with a rigid sphere at. model, and the large deviations may be associated with exciting or ionising collisions. N. M. B.

Transference of charge from slow ions with positive resonance difference. F. WOLF (Physikal. Z., 1937, **38**, 992—994).—Experiments on collision of slow ions with gas mols. show that transference of charge occurs more readily with excess of internal energy than when kinetic energy has to be used. A. J. M.

Kinetic theory of the motion of ions in gases. F. B. PIDDUCK (Physical Rev., 1938, [ii], **53**, 197).—A summary of an original paper (cf. Proc. London Math. Soc., 1915, **15**, 89), and reference to results subsequently rediscovered (cf. Tonks, A., 1937, I, 338). N. M. B.

At. wt. of lead from a specimen of St. Joachimsthal pitchblende. Lead–uranium ratio of this pitchblende. G. P. BAXTER and W. M. KELLEY (J. Amer. Chem. Soc., 1938, **60**, 62—64).—The at. wt. of the Pb specimen is 206·50; the calc. proportion of common Pb is 41·3%. The Pb : U ratio is 0·0314. The calc. age of the mineral is 239×10^6 years, or, by the logarithmic formula, 234×10^6 years. E. S. H.

Separation of the lithium isotopes. Partial separation of ^{6}Li and ^{7}Li by electrolysis. L. HOLLECK (Z. Elektrochem., 1938, **44**, 111—120).—Aq. LiCl (9 kg. in 18 l. of solution) has been electrolysed, using a Hg cathode, until only 0·1% of the LiCl remained. The at. wt. of the Li in the residue, determined by decomp. with $AgNO_3$, was 6·89 as compared with 6·94 for the initial LiCl, indicating an increase of 71% in the [^{6}Li]. The separation factor for electrolysis at a Hg cathode is 1·079. J. W. S.

Enrichment of rubidium isotopes. W. WALCHER (Physikal. Z., 1937, **38**, 961—964).—A method of separating Rb isotopes by means of a mass-spectrograph of high intensity is described. ^{85}Rb (about 6 μg. per hr.) was collected in a C cylinder, which was later used as a cathode in a He discharge tube, and the spectrum was examined. The hyperfine structure of the Rb I resonance line 7800 Å. was investigated for the separated ^{85}Rb and ^{87}Rb, and indicated the purity of the isotopes. A. J. M.

Mass ratio of the carbon isotopes from the spectrum of CN. F. A. JENKINS and D. E. WOOLDRIDGE (Physical Rev., 1938, [ii], **53**, 137—140; cf. A., 1936, 1225).—Using a source containing C enriched about 10 times in ^{13}C, obtained from CH_4 by diffusion by Hertz's method, the violet CN bands were photographed and measurements are given of the lines of low rotational quantum no. in the 0,0, 0,1, and 0,2 bands of $^{13}C^{14}N$ and of $^{12}C^{14}N$. The accurately determined vibrational consts. of the normal states of both mols. give the val. $0{\cdot}97898 \pm 0{\cdot}00002$ for the isotope mass coeff., corresponding with $^{13}C = 13{\cdot}0088$, in agreement with the mass-spectrograph val. N. M. B.

Chemical elements and natural atomic types according to the viewpoint of investigations of isotopes and nucleus. O. HAHN (Ber., 1938, **71**, [*A*], 1—14).—A review of publications from the end of 1936 to the end of 1937. The customary table is extended by the addition of the estimated vals. of the limits of error in the determination of "chemical" at. wts. from physical data. Detailed consideration is given to the elements, H, He, Be, C, O, P, A, K, Zn, As, Br, Kr, Rb, Cd, I, Xe, Cs, Nd, Lu, W, Os, and Pb. H. W.

Mass-spectrography and nuclear structure. J. MATTAUCH (Physikal. Z., 1937, **38**, 951—960).—A review dealing with the "optics" of the mass-spectrograph and methods of increasing resolving power. The use of the mass-spectrograph for the accurate determination of mass defects is considered, and the results are compared with those obtained from energy determinations in nuclear transformations. The β-active isotopes of K and Rb, and the empirical

isobar rule that no two stable isobars which arise from neighbouring elements can exist, are discussed. A further empirical rule is put forward stating that all elements have only one or two stable isotopes of odd mass no., and when there are two they are approx. equally abundant. The same exceptions are found to this rule as to the first. A. J. M.

Second-order focussing mass-spectrograph and isotopic weights by the doublet method. F. W. ASTON (Proc. Roy. Soc., 1937, **A**, **163**, 391—404).—An improved mass-spectrograph having an accuracy approaching 1 in 10^5 is described. The isotopic wt. of ^{12}C was determined with particular care; the packing fraction and isotopic wt. of >20 elements are tabulated, some for the first time. G. D. P.

Atomic masses of the heavy elements. A. J. DEMPSTER (Physical Rev., 1938, [ii], **53**, 64—75).—Investigations reported by Bainbridge (cf. A., 1937, I, 542) for light elements are extended to heavy elements, using as a new source of ions a high-frequency spark between solid electrodes, and comparing at. masses by means of a double-focussing mass spectrograph. The small displacement between the positions of multiply charged ions of one mass and atoms of another mass is measured and gives a val. for the difference in the packing fractions of the two at. masses. Precision data for 21 pairs of ions and approx. data for 8 other pairs are given and discussed. N. M. B.

Genetic relation between indium and tin. E. D. EASTMAN (Physical Rev., 1937, [ii], **52**, 1226—1227; cf. A., 1934, 939).—The widespread association of In with Sn in Sn ores, as shown by existing data, is taken as an indication of a genetic relation ascribed to a "forbidden" transition of ^{115}Sn to ^{115}In. N. M. B.

Radioactive isotopes of zinc and cobalt. C. PERRIER, M. SANTANGELO, and E. SEGRÈ (Physical Rev., 1938, [ii], **53**, 104—105).—The possible formation of radioactive isotopes in Cu filings from the deflecting plate of a cyclotron tank was investigated by adding various elements to Cu solution with subsequent separation and measurement of activities. Absorption and decay curves for Zn and Co give evidence of Zn isotopes of possible masses 64, 65, 66, and 67, and Co isotopes 60 and 62. Mechanisms of formation are discussed. N. M. B.

Modern ideas concerning the nucleus of the atom. L. I. SCHIFF (Gen. Elect. Rev., 1937, **40**, 504—510).—Developments subsequent to Rutherford's nuclear theory of 1911 are reviewed. R. B. C.

Optimum counting-time for measuring the intensity of a radioactive source. J. TANDBERG (Proc. Physical Soc., 1938, **50**, 87—89).—When the intensity of a radioactive source is measured by means of a Geiger–Müller counter, max. accuracy is obtained by continuing the counting for a finite time which depends on the average life of the source and on the intensity of the background interference. N. M. B.

Stability of neon and carbon with respect to α-particle disintegration. L. LANDAU (Physical Rev., 1937, [ii], **52**, 1251).—Kalckar's proposal (cf. A., 1937, I, 544) to explain the observed stability of ^{20}Ne and ^{12}C against α-decay by small *l*–*s* coupling is criticised. An explanation based on the fundamental conservation laws is given. N. M. B.

Collisions of α-particles with neon and deuterium nuclei. J. T. MCCARTHY (Physical Rev., 1938, [ii], **53**, 30—34).—About 600,000 Th-*C* and -*C'* α-particle tracks were photographed in a cloud chamber filled with Ne–D_2 mixture. An analysis of the elastic collisions with Ne atoms gave a range–velocity diagram by which Eaton's curve (cf. A., 1936, 132) was corr. in the region of small velocity. A range–velocity curve is obtained and discussed for collisions with deuterons (cf. Mano, A., 1935, 275). In all cases collisions were elastic. N. M. B.

Resonance effect for (α, *n*) nuclear transformations. E. FÜNFER (Physikal. Z., 1937, **38**, 967—969).—The excitation curves of neutron emission from N_2 and A when bombarded with α-particles of energy 6—7 m.e.v. from Th-*C'* have been obtained. The neutron emission in both cases is not a continuous function of the energy of the α-rays, but takes place in a series of narrow resonance stages, outside which neutrons cannot be detected. The no. of such resonance stages for A is > for N_2 over the same energy interval. The results are discussed in connexion with Bohr's theory of nuclear transformations, with which they agree. A. J. M.

Independence of the disintegrations of polonium atoms. J. THIBAUD and M. FERBER (Compt. rend., 1937, **205**, 1383—1385).—The emission of α-particles from Po has been investigated, using a large source and a counter of small solid angle, and a single-grain source with a spherical counter. Statistical examination of the results shows constancy of emission in the first case, and also in the second case except for very long or very short intervals. A. J. E. W.

Absorption coefficient of β-rays from uranium-*Y*. (MRS.) Z. V. ERCHOVA (J. Phys. Radium, 1937, [vii], **8**, 501—504).—The determination of the coeff. of absorption showed the existence of two groups of β-rays with coeffs. 19·6 and 216 sq. cm. per g. The radioactive const. of U-*Y* is $2{\cdot}90 \times 10^{-2}$. Absorption and decay curves are given. N. M. B.

Heavy β-rays from Ra-*E*. G. E. M. JAUNCEY (Physical Rev., 1938, [ii], **53**, 197).—An extension of an investigation previously reported (cf. A., 1938, I, 115). N. M. B.

Continuous β-ray spectrum of Ra-*E*. A. FLAMMERSFELD (Physikal. Z., 1937, **38**, 973—975).—The continuous β-ray spectrum of Ra-*E* has been investigated from the smallest possible energies to the upper limit, secondary effects being avoided. The curve is compared with the theoretical energy distribution for β-disintegration. The Fermi curve does not agree with the experimental results, but there is good agreement with that of Konopinski and Uhlenbeck for medium energies and up to 100 kv. A. J. M.

Reflexion of β-rays. J. A. CHALMERS (Phil. Mag., 1938, [vii], **25**, 322—334).—Theoretical. The

difference in vals. of the reflexion coeff. of β-rays given by various workers is due to different geometrical conditions. The results of Schonland (Proc. Roy. Soc., 1925, **A**, **108**, 187) and Riehl (A., 1928, 344) have been correlated. A. J. M.

Absorption of the radiation of potassium sulphate and vegetable ashes by thin screens. F. ARTIGAS (Compt. rend., 1937, **205**, 1462—1464).—The results confirm that emission of β-rays by the ashes is due to radioactive K. Vals. of the absorption coeff. μ/ρ for β-rays from K are: Sn, 14·7; Al, 11; Cellophane, 9·4. Fournier's relation between μ/ρ and Z (A., 1927, 915) is obeyed for this radiation. A. J. E. W

Experimental investigation of the atomic nucleus. R. FLEISCHMANN (Physikal. Z., 1937, **38**, 924—929).—A review dealing with improvement of experimental technique, enabling higher intensities to be obtained, the discovery of new types of transformation, absorption of slow neutrons, and the dependence of this absorption on the energy of the neutrons. The existence of isomeric nuclei is also discussed. A. J. M.

Multiple scattering of neutrons. I. Theory of the albedo of a plane boundary. O. HALPERN, R. LUENEBURG, and O. CLARK (Physical Rev., 1938, [ii], **53**, 173—183).—Mathematical. The theory of the motion of particles undergoing multiple collisions in matter is developed and adapted to the case of neutrons incident on a plane boundary. Results are in agreement with observations and capture cross-sections for the diffuse reflexion of slow neutrons at paraffin surfaces. Relations with velocity and magnetic moments of neutrons are discussed. N. M. B.

Angular distribution of protons projected by fast neutrons. P. I. DEE and C. W. GILBERT (Proc. Roy. Soc., 1937, **A**, **163**, 265—281).—Expansion chamber records of about 2000 tracks of protons recoiling from the impacts of neutrons of $2{\cdot}4 \times 10^6$ e.v. have been obtained and the angular distribution functions determined. It is concluded that the distribution of scattered protons is isotropic about the centre of gravity of the colliding particles, and that the force of interaction between neutron and proton is very small at separations exceeding 3×10^{-13} cm. G. D. P.

Spectrum of neutrons from Po + Be. G. BERNARDINI and D. BOCCIARELLI (Ric. sci. Prog. tec., 1936, [ii], **7**, I, 128—130; Chem. Zentr., 1936, i, 4395).—The observed energy spectrum of the reaction ${}^{9}_{4}\mathrm{B} + {}^{4}_{2}\mathrm{He} = {}^{12}_{6}\mathrm{C} + {}^{1}_{0}n + \gamma$ accords with theoretical calculations. J. S. A.

Diffusion of neutrons. I. B. PONTECORVO and G. C. WICK (Ric. sci. Prog. tec., 1936, [ii], **7**, I, 134—137; Chem. Zentr., 1936, i, 4396).—The reflexion of neutrons from Al, Fe, Cu, Ag, Cd, and Au surfaces shows no differences between the two groups. J. S. A.

Excitation function and energy distribution of neutrons produced from boron by Po α-rays. W. MAURER (Z. Physik, 1937, **107**, 721—729).—The excitation function shows 8 sharp resonance levels of which four are definitely ascribed to the $^{11}\mathrm{B}(\alpha, n)^{14}\mathrm{N}$ transition and two are probably ascribable to $^{10}\mathrm{B}(\alpha, n)^{13}\mathrm{N}$. Energy distribution measurements indicate that most of the neutrons arise from $^{11}\mathrm{B}$. L. G. G.

Doppler effect of nuclear resonance level. H. VON HALBAN, jun., and H. PAXTON (Nature, 1938, **141**, 116).—Evidence of broadening of the absorption line for slow neutrons in Ag when the absorber is heated has been obtained. L. S. T.

Neutron absorption limit in cadmium. J. G. HOFFMAN and M. S. LIVINGSTON (Physical Rev., 1937, [ii], **52**, 1228—1231).—In view of divergent data on the absorption of slow neutrons in Cd, the absorption coeff. for neutrons transmitted by Cd was measured in B. These neutrons are inhomogeneous and thus are not absorbed exponentially. Data obtained lead to the val. 0·41 e.v. for the absorption limit in Cd. Resonance energy, half-width, and neutron width are estimated. N. M. B.

Scattering cross-section of fast neutrons by hydrogen. R. LADENBURG and M. H. KANNER (Physical Rev., 1937, [ii], **52**, 1255).—Evidence of a small discrepancy between available data and theoretical vals. is presented. N. M. B.

Artificial disintegration and radioactivation. G. GUÉBEN (Ann. Soc. Sci. Bruxelles, 1937, **57**, 238—283).—An exhaustive survey of investigations for 1936 and the early part of 1937, with tabulated summary and bibliography. N. M. B.

Oppenheimer–Phillips process. H. A. BETHE (Physical Rev., 1938, [ii], **53**, 39—50; cf. A., 1935, 1296).—Mathematical. An examination of the disintegration of nuclei by deuterons with emission of protons (*d–p* reaction). N. M. B.

Ionising power of some atomic nuclei produced by nuclear transformation processes. F. KIRCHNER, H. NEUERT, and O. LAAFF (Physikal. Z., 1937, **38**, 969—973).—The ionising power of the H isotopes and of $^{3}\mathrm{He}$ has been investigated. The max. ionising power is the same for $^{1}\mathrm{H}$, $^{2}\mathrm{H}$, and $^{3}\mathrm{H}$, and is about 45% of that of Po α-particles. The max. ionising power occurs at different distances from the end of the range for the three isotopes. For $^{3}\mathrm{H}$ it is 5·5—6 mm., for $^{2}\mathrm{H}$ 3·8—4 mm., and for $^{1}\mathrm{H}$ 2 mm. from the end. The max. ionising power of $^{3}\mathrm{He}$ from the process $^{6}\mathrm{Li}(p, \alpha)^{3}\mathrm{He}$ is at 3·5 mm. from the end of the range and is 3—5% < that of α-particles. A. J. M.

Measurements of range and angle of projection for the protons produced in the photo-disintegration of deuterium. J. CHADWICK, N. FEATHER, and E. BRETSCHER (Proc. Roy. Soc., 1937, **A**, **163**, 366—375).—The tracks of 62 protons produced in an expansion chamber containing a mixture of He and "heavy" methane irradiated by γ-rays are recorded. The range determinations indicate a binding energy of $2{\cdot}25 \pm 0{\cdot}05 \times 10^6$ e.v. for the deuteron; the angular distribution shows the disintegration to be mainly of the photo-electric type. The binding energy gives 1·0090 as the mass of the neutron. G. D. P.

Resonance emission of protons and α-particles. E. WILHELMY (Z. Physik, 1937, **107**, 769—779).—

Nuclear transformations brought about by a beam of fast neutrons with continuous energy distribution result in emission of discrete groups of protons from S and of α-particles from N, O, F, and S, with energies between 0·4 and 5·0 m.e.v. These are explained as resonance emissions and are discussed with reference to Bohr's latest conceptions of nuclear reactions. H. C. G.

Nuclear transformations and ultra-radiation. (A) E. WILHELMY. (B) W. MAURER. (C) W. GENTNER. (D) W. BOTHE, H. MAIER-LEIBNITZ, and W. MAURER. (E) K. SCHMEISER (Physikal. Z., 1937, **38**, 964—967).—(A) Protons and α-particles emitted by bombardment of N_2, O_2, SF_6, and SO_2 occur in resonance groups. Comparison of results with SF_6 and SO_2 shows that the majority of the groups emitted from the former come from S. The groups characterise certain excitation stages of an intermediate nucleus formed by the introduction of the neutron.

(B) The process investigated by Wilhelmy with N_2 [^{14}N (n, α) ^{11}B] was reversed by bombarding B with Po α-rays of various ranges. Neutrons corresponding with several excitation stages were emitted. Some resonances due to the reaction ^{10}B (α, n) ^{13}N were also found, but of the two processes, this is subordinate.

(C) Addition processes of the (p, γ) type have been investigated. Li, B, F (CaF_2), Na, and Al, all belonging to the $4n$—1 series, were bombarded with protons up to 600 kv., the emitted γ-rays being investigated with regard to variation of their intensity with proton energy, and their hardness. All excitation curves showed resonance stages. For Li, B, F, and Na, (p, α) addition processes can take place. These are compared with the (p, γ) processes with regard to resonance. From the hardness of the γ-rays the quantum energy is calc. In all cases except Li this is < would be expected if the whole binding energy of the proton is radiated as one quantum. The quantum energy decreases with increasing at. no. in agreement with Bohr's theory.

(D) The energy balance of the nuclear reaction ^{10}B (α, p) ^{13}C gives an energy change of 4·0 m.e.v. instead of 3 m.e.v. obtained from earlier determinations of range of protons emitted. Redetermination of the latter gives 3·7 m.e.v. The 80 cm. group of protons belongs to an excited state of ^{13}C, although it has not been possible to demonstrate this experimentally.

(E) The penetrating secondary radiation of ultra-radiation has been investigated. For small angles the second max. of the Rossi coincidence curve is > the first for bundles of different angular divergence from Pb, and represents the hard secondary radiation. A. J. M.

Radiations from artificially produced radioactive substances. IV. γ-Rays from several elements. J. R. RICHARDSON (Physical Rev., 1938, [ii], **53**, 124—127; cf. A., 1937, I, 59).—Investigations and measurements on the γ-radiation from ^{48}V (cf. Walke, A., 1938, I, 8), ^{13}N, ^{64}Cu, ^{27}Mg, and ^{24}Na using an improved H_2-filled cloud chamber (cf. Kurie, A., 1936, 542) are reported and discussed. N. M. B.

Radioactivity of nickel, copper, and zinc. F. A. HEYN (Physica, 1937, **4**, 1224—1228).—Zn irradiated with fast neutrons gives rise to ^{63}Zn or ^{65}Zn (period 40 min.) according to the n,$2n$ reaction, ^{63}Ni (period 2·5 hr.) by capture and the n;$2n$ reaction (this isotope is also obtained by irradiating pure Cu with fast neutrons), and active Cu (period 12·5 hr.). In Zn bombarded with slow neutrons ^{69}Zn is the carrier of the activity (period 60 min.). F. J. L.

Isomeric radio-isotopes of bromine. A. SOLTAN and L. WERTENSTEIN (Nature, 1938, **141**, 76).—Irradiation of Br_2 with fast neutrons up to 14×10^6 e.v., produced by bombarding Li with 350 e.k.v.-deuterons, and with neutrons from the same or from a Rn + Be source and slowed down in a hydrogenated medium, shows that the ratios of formation of ^{80}Br (18 min.) to that of ^{80}Br (250 min.) are 0·56 and 2, respectively. L. S. T.

Mechanical moment of the ^{87}Sr nucleus and the radioactivity of ^{87}Rb. M. HEYDEN and H. KOPFERMANN (Physikal. Z., 1937, **38**, 960—961).—Investigation of hyperfine structure of some red lines of the Sr I spectrum gives 9/2 for the mechanical moment of the ^{87}Sr nucleus. Comparison with the val. for ^{87}Rb shows that the radioactive transformation $^{87}Rb \rightarrow {}^{87}Sr$ is accompanied by a change in nuclear spin amounting to 3. This is in agreement with the β-disintegration theory. There is also a change in nuclear magnetic moment from 2·6 for ^{87}Rb to −1·1 for ^{87}Sr. A. J. M.

Radioactive isotopes of element 43. B. N. CACCIAPUOTI and E. SEGRÈ (Physical Rev., 1937, [ii], **52**, 1252—1253).—A Mo target which had been bombarded with deuterons for many months was analysed chemically. Decay curves of the activity and absorption curves of radiations indicate that the activity of the sample is due to radioactive isotopes of element 43. N. M. B.

Radioactivity induced in ruthenium by neutrons. J. VELDKAMP and H. DE VRIES (Physica, 1937, **4**, 1229).—Ru irradiated with slow neutrons from a Ra–Be source gives active products with periods of 45 sec., 4 min., 4 hr., and 22 hr. F. J. L.

Radioactivity in silver induced by fast neutrons. M. L. POOL (Physical Rev., 1938, [ii], **53**, 116—123; cf. A., 1937, I, 545).—Radioactive ^{112}Ag (3·2 hr.) was produced by fast neutron bombardment of ^{112}Cd and ^{115}In; the upper limit of the electron β-ray spectrum is 2·2 m.e.v., and about 4 γ-rays per β-ray are also emitted. Fast neutron bombardment of ^{107}Ag produces ^{106}Ag (24·5 min. and 8·2 days); the upper limit of the positron β-ray spectrum is 1·9 m.e.v., and of the electron β-ray spectrum 1·3 m.e.v. The 8·2 day product emits a complex γ-ray spectrum with about 35 γ-rays per β-ray; nuclear K electron capture is suggested to explain this anomalously high ratio. Twenty nuclear reactions leading to radioactive Ag are tabulated. N. M. B.

Artificial radioactivity of tantalum. O. OLDENBERG (Physical Rev., 1938, [ii], **53**, 35—39).—Radioactivity was induced in Ta by slow neutrons, fast neutrons, and fast deuterons. Slow neutron capture leads to ^{182}Ta of half-life 97 ± 8 days. Fast neutron bombardment excites, in addition, an 8·2 hr. period with the emission of electrons, Ta K-radiation, and

γ-rays. The 8·2 hr. period is identical with Pool's 9·1 hr. period (cf. A., 1937, I, 490) corr. for the superimposed 97 day period. The process involved is probably the capture of one neutron and the ejection of two neutrons. The product nucleus ^{180}Ta goes over to ^{180}Hf largely by K electron capture with emission of γ-rays or ejection of extranuclear electrons by internal conversion of γ-rays. Deuteron bombardment gives a complicated decay curve rendered inconclusive by impurities. N. M. B.

Origin of cosmic rays. M. C. HOLMES (Physical Rev., 1937, [ii], **52**, 1252).—A discussion of Compton's work (cf. A., 1938, I, 9). N. M. B.

Penetrating cosmic-ray particles. S. H. NEDDERMEYER (Physical Rev., 1938, [ii], **53**, 102—103; cf. A., 1937, I, 390).—The possible existence of particles, not of unique mass intermediate between the proton and electron, but of many masses from a few times the electron mass up to large vals., is discussed. N. M. B.

Theoretical viewpoints concerning the investigation of ultra-radiation. H. EULER (Physikal. Z., 1937, **38**, 943—951).—The accuracy of radiation theory is examined in the light of recent determinations on ultra-radiation by Blackett *et al.* (A., 1937, I, 440) and Neddermeyer *et al.* (*ibid.*, 390). The fundamental processes giving rise to showers by multiplication and explosion are discussed, and the results are applied to Wilson photograph, counter-tube, and ionisation experiments. The spectrum of the soft radiation falling on the earth, and the origin of Hofmann showers, are considered. A. J. M.

Nuclear disintegrations produced by cosmic rays. R. B. BRODE and (MISS) M. A. STARR (Physical Rev., 1938, [ii], **53**, 3—5; cf. A., 1936, 1441).—In 20,500 cloud chamber photographs 215 heavy tracks and 10 nuclear disintegrations associated with 22 heavy tracks were observed. The ejection of a no. of heavy particles from a single source is interpreted as an "evaporation" from a highly excited nucleus. N. M. B.

Artificial radioactivity produced by cosmic rays. W. E. RAMSEY, C. G. MONTGOMERY, and D. D. MONTGOMERY (Physical Rev., 1938, [ii], **53**, 196).—Results reported by Clay (cf. A., 1938, I, 9) are not supported by a modified form of the original investigation. N. M. B.

Energy flux of the corpuscular cosmic radiation. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1938, [ii], **53**, 193—195).—The vertical and total energy flux for depths below the top of the atm. equiv. to 4—43 m. H_2O is obtained by integration from available data and results are in close agreement with those of cloud chamber observations. Assuming that all the cosmic radiation energy is dissipated in ionising and exciting atoms, it is concluded that practically all the energy in the cosmic-ray beam is carried by charged corpuscles, and that the contribution by photons, neutrons, or non-ionising entities is negligible. N. M. B.

Cosmic-ray showers. H. GEIGER (Physikal. Z., 1937, **38**, 936—943).—A review dealing with experimental methods of investigating cosmic-ray showers. The Rossi coincidence curve and the energy distribution in showers are discussed. The types of electron (hard or soft) and the presence of protons in the showers are considered. The absorption of the showers and of the radiation producing them is discussed, and the importance of the probability of encounter of the showers in connexion with coincidence curves is emphasised. A. J. M.

Latitude effect of cosmic ultra-radiation. A. EHMERT (Physikal. Z., 1937, **38**, 975—978; cf. A., 1937, I, 545).—Consideration of absorption curves for perpendicularly incident cosmic rays in depths of H_2O from 0·13 to 1000 m. shows that there are two components, each characterised by a definite absorption exponent. The two components are hard and soft, respectively, and their existence explains phenomena connected with the latitude effect. The hard component consists primarily of electrically charged particles for which there is a fairly simple connexion between energy and range. A. J. M.

Production of cosmic-ray showers in lead. (MISS) M. A. STARR (Physical Rev., 1938, [ii], **53**, 6—14).—Cosmic-ray showers in Pb plates of various thickness placed in a Geiger counter-controlled cloud chamber were photographed and classified according to the no. of particles in the shower and manner of production, either by an ionising particle or by non-ionising radiation. The average shower size increased with plate thickness. Studies of the frequencies of showers of different sizes as a function of plate thickness show that electron-produced and photon-produced showers occur in approx. equal number and are of the same character. Results are in agreement with theory. N. M. B.

Energy distribution in cosmic-ray showers. K. BARSHAUSKAS (Z. Physik, 1937, **107**, 713—718).—Cosmic rays striking a platform of concrete 38 cm. thick liberate showers of radiation which spread out from the concrete in a divergent beam. Radiation near the centre of the beam, within a solid angle of 7°, liberates further radiation on striking Pb but that in the outer beam is absorbed by Pb. H. C. G.

Heavy particles in cosmic radiation at a height of 4250 metres above sea-level. V. VEKSLER and B. ISAEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 189—192).—A system of proportionate counters has been devised to measure the no. of heavy particles produced by cosmic radiation and the ionisation which they produce. The no. of heavy particles (absorbed by 0·75 or 1·5 mm. of Fe) is not increased by placing Al over the counters, so Al does not emit appreciable nos. of heavy particles. J. W. S.

[Cosmic] showers studied at a height of 4250 metres above sea-level. V. VEKSLER and B. ISAEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 193—194; cf. preceding abstract).—The dependence of the no. of coincidences in proportional counters on the thickness of the Pb screen shielding them indicates that a large no. of the coincidences are due to cosmic showers. J. W. S.

Sidereal diurnal variation in cosmic-ray intensity. S. E. FORBUSH (Physical Rev., 1937, [ii], **52**, 1254). N. M. B.

Counting properties of baked-out counter tubes filled with pure hydrogen. H. EGELHAAF (Z. Physik, 1937, **108**, 19—23).—The effect of purity of electrode materials, H_2 filling, degassing, and baking out of counter tubes is studied. L. G. G.

Origin of the *X* particle. G. E. M. JAUNCEY (Physical Rev., 1937, [ii], **52**, 1256; cf. Street, A., 1938, I, 9).—Mathematical. N. M. B.

Does the formula for the Rydberg constant require revision? J. W. M. DU MOND (Physical Rev., 1937, [ii], **52**, 1251; cf. A., 1937, I, 214).—Discrepancies in the val. of h/e by eight different methods are discussed with reference to estimated error limits. The weighted mean lies away from the Rydberg const. val., suggesting the need for revision. Empirically, a const. multiplier $(1 - \alpha^{-1})$, where α is of the order 137, removes the discrepancy. N. M. B.

Structure and magnitude of the electron. J. ROMAÏDÈS (Praktika, 1935, **10**, 164—170; Chem. Zentr., 1936, i, 4393).—Theoretical. An electron is regarded as a group of electromagnetic waves rotating about the direction of propagation. J. S. A.

Tensorial equations of the magnetic electron. J. YVON (Compt. rend., 1937, **205**, 1367—1369).—Mathematical. A. J. E. W.

Nuclear forces, heavy electrons, and the β-decay. H. J. BHABHA (Nature, 1938, **141**, 117—118).—A generalisation of Yukawa's theory (Proc. Phys. Math. Soc. Japan, 1935, **17**, 48) showing that nuclear forces can be explained by assuming the existence of new particles of mass ~200 times that of the electron. L. S. T.

Spin of the neutron. J. SCHWINGER (Physical Rev., 1937, [ii], **52**, 1250).—Mathematical. An examination of data on the scattering of neutrons by ortho- and para-H_2 (cf. A., 1937, I, 543) points to the val. $\frac{1}{2}\hbar$ for intrinsic angular momentum of the neutron. N. M. B.

Magnetic moments of the proton and the neutron. H. FRÖHLICH and W. HEITLER (Nature, 1938, **141**, 37—38).—Theoretical. In order to explain the magnetic moment of the proton and of the neutron, the existence of unstable particles with a mass of ~100 times that of the electron is postulated. Such particles may form the hard component of cosmic radiation. It is assumed that, in suitable circumstances, a proton (or neutron) can emit a positive (or negative) heavy electron, transforming itself into a neutron (or proton). L. S. T.

Nature of the interaction between neutron and proton from scattering experiments. H. S. W. MASSEY and R. A. BUCKINGHAM (Proc. Roy. Soc., 1937, **A**, **163**, 281—297).—The possibility of deciding the nature of the force between a neutron and a proton from experiments on the angular distribution of protons projected by neutron collision is subjected to mathematical analysis. The available experimental evidence does not allow any reliable conclusion to be reached. G. D. P.

Collision of proton and deuteron. K. OCHIAI (Physical Rev., 1937, [ii], **52**, 1221—1225).—Mathematical. Calculations analogous to those of Schiff (cf. A., 1937, I, 489) for neutron–deuteron collisions are developed. Results disagree with experiment for large angle scattering. N. M. B.

Theory of nuclear reactions. L. GOLDSTEIN (Compt. rend., 1938, **206**, 42—44).—Mathematical. A. J. E. W.

Excited states of the α-particle. H. MARGENAU (Physical Rev., 1938, [ii], **53**, 198; cf. Feenberg, A., 1936, 401).—Mathematical. N. M. B.

Heavy particles and the neutrino. G. E. M. JAUNCEY (Physical Rev., 1938, [ii], **53**, 106; see above).—Mathematical. Energy considerations in the production of the *x* particle are discussed. N. M. B.

Ratio of the masses of the fundamental particles. H. T. FLINT (Proc. Physical Soc., 1938, **50**, 90—95; cf. *ibid.*, 1936, **48**, 433).—Mathematical. N. M. B.

Calculation of atomic energy levels. II, III. T. YAMANOUCHI (Proc. Phys.-Math. Soc. Japan, 1936, **18**, 10—22, 23—24). CH. ABS. (*e*)

Nature of the nuclear field. N. KEMMER (Nature, 1938, **141**, 116—117).—A modification of Yukawa's theory is advanced. L. S. T.

Approximately relativistic equations. G. BREIT (Physical Rev., 1938, [ii], **53**, 153—173; cf. A., 1937, I, 341).—Mathematical. N. M. B.

Theoretical investigation of nuclear forces. F. HUND (Physikal. Z., 1937, **38**, 929—935).—A review of recent progress in nuclear theory, dealing particularly with forces between nuclear particles and the structure of the nucleus. A. J. M.

Existence of a shortest wave-length. A. MARCH (Z. Physik, 1937, **108**, 128—136; cf. A., 1937, I, 546).—Theoretical. The probability of a shortest λ comparable in magnitude with the classical electron radius is discussed. L. G. G.

Maximum energy obtainable from the cyclotron. H. A. BETHE and M. E. ROSE (Physical Rev., 1937, [ii], **52**, 1254—1255).—Mathematical. A serious difficulty, due to relativistic change of mass, is predicted if attempts are made to accelerate ions in a cyclotron to higher energies than hitherto attained. N. M. B.

Origin of stellar energy. L. LANDAU (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 305—306).—The crit. mass at which a star passes from an electronic to a neutronic state of high *d* is calc. The formation of a steadily growing neutronic core is suggested as a source of stellar energy. R. S. B.

Universal constant for band spectra. Attribution of lines of a band to causes other than rotation of the molecule. H. DESLANDRES (Compt. rend., 1937, **205**, 1337—1340).—The application of the formula $\nu = qd_1/r's'$ (where d_1 is a universal const., 1062·5, q and r' are integers, and s' is the no. of excited electrons in an atom) (cf. A., 1925, ii, 930) to vibra-

tional and rotational lines is discussed. Doubt is cast on the attribution of the latter to mol. rotation. In the case of the rotational lines of a mol. AB, s' in the above formula becomes $s'_1 s'_2$, where s'_1 and s'_2 are the nos. of excited electrons in A and B. A. J. E. W.

Diffraction of light by ripples on liquid surfaces. I. D. S. SUBBARAMAIYA (Proc. Indian Acad. Sci., 1937, **6**, **A**, 333—339).—The spectra obtained by diffraction of Hg light λ 5461 A. by a system of ripples travelling along a liquid surface have been photographed. The amplitude of the ripples is calc. from the distribution of intensity in the diffraction spectra. Damping is increased by partly covering the surface with a unimol. film; the ratio of the amplitude of the damped wave to that of the undamped is approx. ∝ the area of the surface covered by the film. F. J. L.

Interstellar molecules. P. SWINGS and L. ROSENFELD (Astrophys. J., 1937, **86**, 483—486).—The nos. of certain mols. in interstellar space have been computed. A search for the bands of CH, OH, NH, CN, and C_2 is desirable. L. S. T.

Photochemistry of planetary atmospheres. R. WILDT (Astrophys. J., 1937, **86**, 321—336; cf. A., 1935, 424).—Photochemical reactions involving CH_4, CO_2, and NH_3 are discussed. The existence of CH_4 and the failure to detect any other hydrocarbon indicate the presence of considerable H on giant planets, and probably there is no CO, CO_2, or H_2S at their surfaces. L. S. T.

Thermal radiation and absorption in the upper atmosphere. G. H. GODFREY and W. L. PRICE (Proc. Roy. Soc., 1937, **A**, **163**, 228—249).—The radiative equilibrium at 100 km. is discussed, taking account of the absorbing properties of O_3, H_2O vapour, and O_2. It is concluded that the existence of temp. of the order of 1000° or more in the F region of the ionosphere is a necessary consequence of the presence of appreciable quantities of O_2 at these levels. G. D. P.

Band spectra of PbSe, SnSe, and PbTe in absorption. J. W. WALKER, J. W. STRALEY, and A. W. SMITH (Physical Rev., 1938, [ii], **53**, 140—145).—Full data and vibrational analyses are tabulated. The band-heads degrade towards the red, and expressions for the heads are found. Vibrational coeffs. are compared with those of the band systems in PbO, SnO, PbS, and SnS, and the expected trend is found. N. M. B.

Band spectrum of antimony chloride. I. HUDES (Physical Rev., 1937, [ii], **52**, 1256).—The band spectrum attributed to SbCl in the region λλ 4200—5600 has been excited by means of active N, and consists of two sub-systems degraded towards the red. Expressions for the heads of 28 bands are given. N. M. B.

Calculation of the absorption limits of silver halides. N. KAMEYAMA and S. KIKUCHI (J. Soc. Chem. Ind. Japan, 1937, **40**, 396—397B).—The absorption limits of AgCl and AgBr have been calc. to be 3250 and 4100 A., respectively, for the ideal crystal. The small discrepancy from the observed vals., which are approx. 3900 and 4350—4600 A., respectively, is due to imperfections in the crystals. R. S. B.

Absorption of ultra-violet rays by solutions of potassium and sodium vanadate. J. J. MICHAILENKO and K. G. SCHVEBELBLIT (Redk. Metal, 1935, **4**, No. 3, 19—27).—A sharp change in the absorption of various λλ in the range 2300—4500 A. by 0·0005M-K_3VO_4 and -Na_3VO_4 occurs when the [H·] is 2·5—3·0 times the [VO_4''']. This indicates the beginning of the dehydration of VO_4'''. CH. ABS. (e)

Change in absorption spectra of complex chromium salts with heavy water and heavy ammonia as constituents. B. DUHM (Z. physikal. Chem., 1937, **B**, **38**, 359—365).—The influence on the absorption spectra of the substitution of H by D in $[Cr(H_2O)_4Cl_2]Cl$, $[Cr(NH_3)_5Cl]Cl_2$, and $[Cr(NH_3)_6]Cl_3$ has been investigated at 20° and 83° K. The line displacements, which amount to 2—7 A., are due, in part, to a crowding of the individual line groups, as a result of the D mols. having smaller fields than the corresponding H mols. The prep. of the D compounds is described. C. R. H.

Ultra-violet absorption of carbon disulphide. (MISS) O. AMIOT and (MISS) H. MARSAC (J. Phys. Radium, 1937, [vii], **8**, 498—500).—Using an intense light source and thin layers of dil. solutions of CS_2 in hexane, the absorption band at 3200 A. was resolved into six elementary bands. N. M. B.

Emission spectrum of carbon tetrachloride. R. K. ASUNDI and S. M. KARIM (Proc. Indian Acad. Sci., 1937, **6**, **A**, 328—332).—The emission spectrum of flowing CCl_4 vapour at 0·2—0·3 mm. Hg exhibits continuous bands $\lambda_{max.}$ 4600, 3348, 3070, 2580, 2430, 2300 A., and a group of strong bands λλ 2796—2777 A. which coincide with, but are not, the (0,1) bands of the $5B$ system of CO. In addition a group of bands λλ 2846—2862 is observed. The analysis of these groups suggests that the emitter is a diat. mol., probably CCl. The excitation energy is 4·40 e.v. F. J. L.

Absorption spectra of liquid methyl iodide and its solutions in hexane. D. PORRET (Helv. Chim. Acta, 1938, **21**, 7—16).—The extinction coeffs. of liquid MeI and of solutions of MeI in C_6H_{14} have been measured over the frequency range 17,000—47,000 cm.$^{-1}$, and are compared with the vals. for the vapour (A., 1937, I, 342). All show a max. at 38,800 cm.$^{-1}$ and a min. on the short-λ side, but there are intensity differences which are discussed. The results are discussed from the point of view of the quantum theory, and potential energy curves are determined for the fundamental and two excited states. J. W. S.

Comparison of absorption spectra of some typical unsymmetrical cyanine dyes. B. BEILENSON, N. I. FISHER, and F. M. HAMER (Proc. Roy. Soc., 1937, **A**, **163**, 138—155).—Absorption curves (λ = 300—800 mμ.) of 105 ethiodides in MeOH solution have been investigated. The results are tabulated. The observed vals. of λ for max. absorption are compared with those calc. by taking the mean the λλ of max. absorption of the two related symmetrical

cyanines. Good agreement is obtained in the carbocyanine series; a quinoline nucleus produces divergence. In the absence of quinoline the frequency change produced by lengthening the C chain joining N atoms from 3 to 5 members is > that produced by lengthening it from 5 to 7 members. The frequency decrease caused by adding two C_6H_6 rings becomes smaller as the C chain joining N atoms is lengthened. Introduction of one C_6H_6 ring almost always decreases the frequency of max. absorption. G. D. P.

Reversible polymerisation causing absorption bands of a new kind in dyestuffs. G. SCHEIBE (Kolloid-Z., 1938, **82**, 1—14).—An account of work previously published (A., 1937, I, 165, 216, 494).—F. L. U.

Ammoniacal absorption spectrum of stercobilin and urobilin and its relationship to the constitution of bilirubinoid pigments.—See A., II, 71.

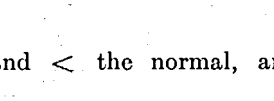
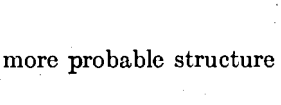
Investigation of the intermolecular forces of water by means of the infra-red spectrum. G. BOSSCHIETER (Chem. Weekblad, 1937, **34**, 799—803).—Measurements are recorded of the absorption in the region of 2·8—4·0 μ. of dil. solutions (0·01%) of H_2O in CCl_4 and CS_2 and of more conc. solutions in dioxan, $COMe_2$, C_5H_5N, etc. and their bearing on the structure of H_2O is discussed. Measurements on HDO and D_2O are also included. S. C.

Absorption of carbon dioxide in the region of the band at 4·3 μ. between 300° and 1000° K. C. TINGWALDT (Physikal. Z., 1938, **39**, 1—6).—The spectral absorption of CO_2 and CO_2–N_2 mixtures has been investigated between 300° and 1000° K. The emissivity, ϵ, was calc. but results do not agree with those of Schack (Z. tech. Physik, 1924, **5**, 267). The dependence of ϵ on concn. at room temp., however, agrees with that calc. from the formula of Schack. A. J. M.

Infra-red absorption maxima of alkali halides. J. A. WASASTJERNA (Soc. Sci. fenn. Comm. phys.-math., 1936, **8**, No. 19, 11 pp.; Chem. Zentr., 1936, i, 4402).—Characteristic frequencies are calc. on the assumption that only the electrostatic summation extends over the whole lattice in ionic crystals, other interactions being localised between neighbours. J. S. A.

Transmission of blende and of some halogen derivatives of copper and cadmium in the far infra-red. M. PARODI (Compt. rend., 1937, **205**, 1224—1226).—λλ of absorption bands in the range 30—60 μ. are recorded for ZnS, CuCl, CuBr, CuI, $CdCl_2$, and $CdBr_2$, each of which has one band in the range studied. The λλ of the bands are in agreement with vals. calc. from the formulæ of Born, Madelung, and Lindemann. A. J. E. W.

Infra-red spectrum and structure of silicates and glasses. F. MATOSSI (Physikal. Z., 1937, **38**, 1011—1014).—Infra-red reflexion spectra of glasses and silicates are similar. The position of the reflexion max. depends on the composition of the glass. Quartz glass appears to contain crystallites. A. J. M.

Infra-red absorption spectrum of phosgene. C. R. BAILEY and J. B. HALE (Phil. Mag., 1938, [vii], **25**, 98—111).—Data are recorded and applied as a test for the general theory that the mol. forces characteristic of certain groups remain const. in passing from one mol. to another. A comparison of the force consts. with those of other mols. suggests that the C—Cl and C=O distances in $COCl_2$ are respectively > and < the normal, and that  is a more probable structure than 

C. R. H.

Infra-red absorption spectra and modes of vibration of benzene derivatives. I. Mono-substitution derivatives. J. LECOMTE (J. Phys. Radium, 1937, [vii], **8**, 489—497).—Modes of vibration from 6 to 16 μ. are discussed and identified with frequencies previously reported (cf. A., 1937, I, 344). N. M. B.

Infra-red absorption of benzene, chloro- and bromo-benzene. M. BATTISTA (Nuovo Cim., 1937, **14**, 343—349).—The infra-red absorption of C_6H_6, PhCl, and PhBr in the range 0·8 to 8 μ. has been measured. The first fundamental frequency, ν_1, corresponding with the max. at 3·3 μ., is found together with its three higher harmonics in all three substances and is attributed to the C–H linking. O. J. W.

Infra-red absorption of chloroform and of bromoform. A. MAIONE (Nuovo Cim., 1937, **14**, 361—364).—The infra-red absorption of $CHCl_3$ and $CHBr_3$ in the range 0·8 to 9 μ. has been measured. Both substances show the fundamental frequency ν_1 (and its three harmonics) which occurs in aromatic substances and is attributed to the C–H link (cf. preceding abstract). The assignment of other frequencies is discussed. O. J. W.

Band spectra of the halides of mercury, cadmium, and zinc. P. TRAUTTEUR (Nuovo Cim., 1937, **14**, 365—375).—The emission spectra in the visible region of HgI, CdI, and ZnI have been measured. For these three mols. the relationship between dissociation energy and reduced mass is linear, and in the ground level the metal atom appears to be in a 1*S* state. O. J. W.

Structure of Rayleigh radiation of liquids. K. BIRUS (Physikal. Z., 1938, **39**, 80—90).—The Rayleigh radiation from PhMe, EtOH, and H_2O has been examined. The coherent radiation perpendicular to the incident light is completely linearly polarised in the plane containing these two directions, and is due to density variations in the liquids. There was doublet-splitting of this radiation as required by Debye's wave theory of heat, but the radiation also contained a portion of which the frequency was unchanged, the intensity of this being determined by ν. The ratio of intensities of the symmetrical triplet is $c_\nu/2 : (c_p - c_v) : c_\nu/2$. The incoherent "anisotropy" radiation is related to the Raman radiation,

corresponding with rotational Raman scattering in the vapour state. It contains no unchanged primary radiation. A. J. M.

Smekal–Raman effect and its chemical applications. A. SIMON (Chem.-Ztg., 1938, **62**, 69—74).—A review.

Molecular oscillations and Raman spectra. O. REDLICH (Österr. Chem.-Ztg., 1938, **41**, 25—28; cf. A., 1936, 1319; 1937, II, 496).—A general exposition, with special reference to C_6H_6 and its deutero-derivatives. F. L. U.

Raman effect in gases under normal pressure. J. CABANNES and A. ROUSSET (Compt. rend., 1938, **206**, 85—88; cf. A., 1936, 922).—Raman frequencies have been determined: N_2 2331, O_2 1554, CO 2143, NO 1876, NO_2 1285 and 2223, CO_2 1389, NH_3 3335, and H_2 4145 cm.$^{-1}$, and depolarisation factors have been calc. In gaseous NH_3, in addition to the frequency 3335 (polarised) and 3520 (depolarised) a feeble line 3219 cm.$^{-1}$ was observed, corresponding with 3210 cm.$^{-1}$ in the liquid. R. S. B.

Additional Raman frequencies for water. I. R. RAO and P. KOTESWARAM (Phil. Mag., 1938, [vii], **25**, 90—98).—A crit. study of intensity and frequency vals. of the Raman bands of H_2O, and of the effect of temp. and addition of electrolytes (cf. A., 1937, I, 496). Magat's and also Hibben's assignments are discussed and some lines are attributed to excitation by other Hg lines all giving the 3200—3600 region. C. R. H.

Note on the δ(CH) vibration in sodium formate. J. GUPTA (Indian J. Physics, 1937, **11**, 333—335).—The Raman lines λλ 1353 cm.$^{-1}$ in HCO_2Na and 1398 cm.$^{-1}$ in HCO_2H which were previously attributed to the deformation oscillation of (C—H) are doublets arising from the accidental coincidence of the above frequency with an inner vibration of the CO_2H group. F. J. L.

Raman effect. LXXIX. Five-membered ring. 3a. Polarisation measurements with pyrrole, furan, and thiophen. A. W. REITZ (Z. physikal. Chem., 1937, **B**, **38**, 275—291).—In the frequency region below 1700 cm.$^{-1}$ pyrrole has five polarised lines and furan and thiophen have six. The structure of all three compounds probably corresponds with the point-group C_{2v}. R. C.

Raman effect. LXXXI. Five membered ring. 3b. Polarisation measurements on *cyclo*-pentane, -pentanone, -pentene, -pentadiene. A. W. REITZ (Z. physikal. Chem., 1937, **B**, **38**, 381—392).—Data are recorded and compared with data for furan, thiophen, and pyrrole. The discussion is a continuation of previous discussions on the structure of these compounds (cf. A., 1936, 1180; 1937, I, 283, and preceding abstract). C. R. H.

Depolarisation of Raman lines. E. CANALS and (MLLE.) J. GASTAUD (Bull. Soc. chim., 1937, [v], **4**, 2042—2048).—The state of polarisation of the Raman lines of several aliphatic compounds has been determined. In all the compounds the lines provided by similar vibrations are in the same state of polarisation; the nature of the principal vibrations is not modified by substituents. The lines corresponding with C·C (450, 800, 950 A.) are always polarised; of the two lines of Me in the region 1400 A., one is always polarised. C·O in alcohols gives a line about 1050 A., which is partly polarised. The line for C:O (1650 A. for acids, 1730 A. for esters and ketones) is polarised and shows a common origin. The spectrum of paraldehyde shows the line C·O in the same state of polarisation as in alcohols, but does not show the line C:O, thus confirming a cyclic structure. E. S. H.

Depolarisation of Raman lines of some alicyclic derivatives. E. CANALS, M. MOUSSERON, L. SOUCHE, and P. PEYROT (Bull. Soc. chim., 1938, [v], **5**, 79—83; cf. A., 1936, 777, 1050).—Frequency, intensity, and state of polarisation are listed and discussed for Raman lines of 29 compounds, comprising epoxy*cyclo*-hexane and -pentane and *cyclo*hexene, with alkyl and aryl derivatives, and alkyl derivatives of *cyclo*pentene. I. McA.

Raman spectra of halogenated alicyclic derivatives. E. CANALS, M. MOUSSERON, R. GRANGER, and (MLLE.) J. GASTAUD (Bull. Soc. chim., 1937, [v], **4**, 2048—2051).—Spectral data are recorded for: *cyclo*pentane, chloro-, 1 : 2-dichloro-, bromo-, 2 : 2-dibromo-*cyclo*pentane, 2-chloro-, 2-bromo-*cyclo*pentanol, *cyclo*hexane, chloro-, 2 : 2-dichloro-, bromo-, 1 : 2-dibromo-, 2-chloro-2-bromo-*cyclo*hexane, *cyclo*hexanol, 2-chloro-, 2-bromo-*cyclo*hexanol. E. S. H.

Intensities of Raman lines due to lattice oscillations. S. C. SIRKAR (Indian J. Physics, 1937, **11**, 343—348).—Raman lines due to lattice oscillations have no appreciable intensity when the arrangement of cations on opposite sides of an anion is symmetrical (cf. Menzies and Mills, A., 1935, 564). The arrangement of the mols. in $C_{10}H_8$, *p*-$C_6H_4Cl_2$, and *p*-$C_6H_4Br_2$ is discussed and it is shown that there can be no asymmetry in the arrangement of two mols. on opposite sides of any particular mol.; hence the Raman line due to lattice oscillations is weak. The strong lines observed in the Raman spectra of these crystals near the Rayleigh line are due to oscillations in polymerised groups. F. J. L.

Raman spectra of some diacylamines. B. V. THOSAR (Z. Physik, 1937, **107**, 780—784).—Raman spectra are photographed for a no. of di-*n*- and -*iso*-alkylamines. Three general groups of lines found correspond respectively with the C–C deformation vibration, the C–C and the C–N valency vibrations, but numerical differences in the displacements are observed between the *n*- and *iso*-compounds and between these and the allyl compound. L. G. G.

Luminescent photographic method of measuring the energy distribution in the ultra-violet. L. N. ANANEVA and A. A. SCHISCHLOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 183—187).—A thin gelatin film, impregnated with Na salicylate and mounted on SiO_2, is placed in contact with the emulsion of the photographic plate used in ultra-violet spectroscopy. The blackening of the plate, due to the blue fluorescence of the Na salt, ∝ the intensity of the incident ultra-violet radiation. The

intensity distribution in the H_2 spectrum, as measured by this method, is in accord with the results of Chalonge (A., 1934, 339). J. W. S.

Radiation emitted by solid dielectrics electrified by friction. F. PERRIER (Compt. rend., 1938, **206**, 107—109).—The radiation emitted after rubbing amber, ebonite, S, and paraffin does not produce fluorescence with the usual screens, but forms gaseous ions. The absorption coeff. has been measured in air. R. S. B.

Energy yield of fluorescent substances. H. HELLSTRÖM (Arkiv Kemi, Min., Geol., 1937, **12**, **A**, No. 17, 12 pp.).—The fluorescence energy yield ρ is the ratio of fluorescence energy emitted to light energy absorbed. Design, theory, and use of an apparatus (fluorometer) for its determination by the direct method (Frank and Wood, A., 1936, 1320) are described. Measurements for fluorescein, eosin, rhodamine-B (aq.), methylene-blue (in EtOH), and ætioporphyrin (in Et_2O) agree with published vals. I. McA.

"Anomalous" anti-Stokes fluorescence. F. DUSCHINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 179—182).—Theoretical. J. W. S.

Emission spectra of zinc sulphide phosphors, and effect of cadmium sulphide on the emission of zinc sulphide and alkaline-earth sulphide phosphors. S. ROTHSCHILD (Z. Physik, 1938, **108**, 24—39).—Measurements of max. in the emission spectra of various ZnS phosphors are recorded and it is established that the addition of foreign metals (Ag, Cu, and Mn) gives rise to a sp. shift of the max. Addition of CdS to ZnS phosphors shifts the max. of the emission band towards the red by an amount approx. $\propto$ the molar concn. of CdS, which also forms mixed phosphors with SrS and CaS. H. C. G.

Fluorescence of the rare earths. H. GOBRECHT (Ann. Physik, 1938, [v], **31**, 181—186; cf. A., 1937, I, 281).—The absorption and fluorescence of $Ce_2(SO_4)_3$ are described. Fluorescence bands were observed with max. at 3444 and 3220 A. for solid $Ce_2(SO_4)_3$ and at 3650 A. for the aq. solution. Tm shows fluorescence in the borax bead but not in the solid state. O. D. S.

Relation between emission spectra of Nd^{+++} in phosphors and the absorption spectra of the same in crystals. P. C. MUKHERJI (Indian J. Physics, 1937, **11**, 295—304).—The absorption spectrum of Nd^{+++} in crystals is classified, and the emission spectra of the ions incorporated in K_2SO_4 and CaO are measured. The phosphorescent radiations appear to be wholly quadruple in nature involving changes in L and $J \not> 2$ units. The possible transitions are discussed in the light of Van Vleck's theory. F. J. L.

Selective extinction of continuous fluorescence spectra. N. A. PRILESHAEVA (J. Phys. Chem. Russ., 1937, **10**, 342—352).—The intensity of ultra-violet fluorescence of the vapours of PhMe, PhEt, PhOH, and NH_2Ph at 0·1 to 10 mm. Hg is uniformly lowered by admixture of small (<5 mm.) or large (>25 mm.) amounts of N_2, CO, H_2, CO_2, or H_2O. Moderate admixtures show selective extinction (position independent of the vapour). N_2 quenches between 3340 and 3320, 3120 and 3110, 2950 and 2920, and 2800—2790 A., CO between 3420 and 3410, 3235 and 3215, 3050 and 3040, and 2915 and 2895 A., H_2 between 3020 and 3010, and 2810 and 2800 A., CO_2 between 2830 and 2815 A., H_2O between 2975 and 2960 A. O_2 and NH_3 do not extinguish. An explanation is given for the position of the extinction bands. J. J. B.

Sensitised fluorescence in benzene and aniline vapours. N. A. PRILESHAEVA and A. A. KLIMOVA (J. Phys. Chem. Russ., 1937, **10**, 353—359).—C_6H_6 and NH_2Ph vapours fluoresce when irradiated with λ between 2300 and 2600 A. and between 2500 and 2850 A., respectively. When mixed with C_6H_6, however, NH_2Ph fluoresces even at <2500 A., and C_6H_6 does so at 2800 A. when mixed with NH_2Ph. The source of the energy necessary for the "anti-Stokes" fluorescence of C_6H_6 is unknown. J. J. B.

Solid dielectrics in alternating electric fields. F. BORGNIS (Z. Physik, 1937, **108**, 107—127).—Theoretical. The validity of equations of the type $i = B(0 + t)^{-n}$ as a measure of the secondary effect current decay is examined. L. G. G.

Emission picture of thoriated tungsten and thoriated molybdenum. II. Influence of carburation on thoriated tungsten. E. BRÜCHE and H. MAHL (Z. tech. Physik, 1936, **17**, 81—84; Chem. Zentr., 1936, i, 4679).—The influence of carburation and deactivation on the emissivity is studied with the electron microscope. Carburation lowers the reduction temp. of the ThO_2, and loosens the texture of the W, thereby facilitating diffusion of the Th to the grain boundaries. J. S. A.

Origin of photo-electrons in very thin films of alkali metals deposited on another metal. H. MAYER (Naturwiss., 1938, **26**, 28).—The efficiency of a photo-cell composed of Cs or K on W or Pt has been investigated with varying thicknesses of alkali metal for a series of monochromatic radiations of λ 2000—8000 A. The photo-efficiency of a film of Cs or K somewhat < monat. on Pt is 7 times that on W. For a film of Cs five atoms thick the yield was the same for both Pt and W. At this thickness the photo-electrons begin to arise from the alkali metal. A. J. M.

Most favourable thickness for thermo-electric and photo-electric effects with thin films of alkali metals on other metals. H. MAYER (Naturwiss., 1938, **26**, 28—29).—The average thickness of Cs deposited on W giving the greatest photo-electric effect for monochromatic radiations of λ 2482, 2540, 2655, 3132, 3341, 3655, and 4047 A. was $3{\cdot}1_5 \times 10^{14}$ Cs atoms per sq. cm. of W. The thickness of Cs deposited on Pt giving the greatest photo-electric effect for λ 5779 A. is the same as that giving the greatest thermo-electric effect at 360°, viz., $2{\cdot}4 \times 10^{14}$ Cs atoms per sq. cm. of Pt. A. J. M.

Electronic conduction and photochemical processes in alkali halide crystals. R. W. POHL (Physikal. Z., 1938, **39**, 36—54).—A review dealing with the optical properties of pure crystals of alkali halides, and those with a stoicheiometrical excess of

alkali metal or halogen, containing colour centres. The photo-electric and thermo-electric currents produced in such crystals are dealt with. Photochemical processes in crystals of alkali halides are considered, and their application to the case of Ag halides is mentioned. A. J. M.

Transparent composite photo-cathodes. P. GÖRLICH (Z. tech. Physik, 1937, **18**, 460—462).—The effect of O_2 on the spectral distribution of transparent photo-cathodes of the type Sb–M and Bi–M (M = Li, Na, K, Rb, Cs) has been investigated. O_2 sensitises the cathode, usually causing a displacement of the long-wave max. towards the red, dependent on the degree of sensitisation and on the thickness of the film, as well as other factors. Two long-wave max., usually only slightly marked, were found for a no. of cathodes. Thicker, opaque cathodes of the type Sb–M and Bi–M give approx. the same spectral distribution, but the photo-current is about 1% < that of transparent cathodes. If, however, a transparent cathode is backed by a thick, opaque film of a good conductor (*e.g.*, Ag) the photo-current and spectral distribution are unaffected. A. J. M.

Theory of semi-conductors in a magnetic field. M. SENGUPTA (Indian J. Physics, 1937, **11**, 319—332).—The change in the resistance of semi-conductors in a magnetic field is investigated, using the model of Wilson and Fowler as the basis for calculations. F. J. L.

Primary and secondary photo-electric currents in crystals. KH–KBr mixed crystals as model semi-conductors. R. HILSCH and R. W. POHL (Z. Physik, 1938, **108**, 55—84).—All photo-electric currents in crystals may be calc. independently of the nature and magnitude of the dark conductivity, provided that the electron leakage in the crystal follows an exponential law, and that the homogeneous internal field is not disturbed by illumination. Secondary photo-electric currents occur only in crystals where a portion of the dark conductivity is electronic. Calculation of these currents, and the experimental realisation of the conditions, are discussed for semi-conducting KH–KBr mixed crystals. H. C. G.

Field emission from composite cathodes on irradiation with electrons. H. MAHL (Physikal. Z., 1937, **38**, 985—989).—The presence of a field emission from the Al substratum of the composite cathode Al–Al_2O_3–Cs_2O, assumed by Malter (A., 1936, 540) to explain anomalous emission from the cathode when irradiated by electrons, has been shown to exist by direct measurement. There is a positive surface charge of 10—40 v. for an Al_2O_3 layer of thickness 2000 A. The energy distribution of electrons released from the cathode has been investigated. They are field electrons, and at least the more rapid of them arise from the Al. They have energies of 10—15 v. and are emitted without loss of energy. Some, however, suffer an energy loss in the Al_2O_3 or arise from different depths of the Al_2O_3. The cathode was examined by the electron microscope, and it was found that the field emission is not uniformly distributed over the cathode but arises from certain emission centres. The above results are general for a cathode consisting of a metal covered with a thin insulating film which becomes sufficiently positively charged by secondary emission. A. J. M.

Blocking layer photo-electric effect of cæsium oxide. H. TEICHMANN (Phil. Mag., 1938, [vii], **25**, 269—273).—The theory that the intermediate layers of composite photo-cathodes act as semi-conductors leads to the conclusion that Cs_2O must show semi-conducting properties, and that it must be possible to show the existence of a blocking layer photo-effect and a rectifying effect. A cell is described with which the blocking layer effect can be demonstrated. There is a linear dependence of this effect on the intensity of the light for intensities of the order of 10^{-3} g.-cal. per sec. A. J. M.

Volume-rectification of crystals. B. K. SEN (Nature, 1937, **140**, 1102).—The existence of so-called vol.-rectification in galena, Fe pyrites, and pyrolusite placed between Hg electrodes has been demonstrated (cf. A., 1935, 682). Either surface- and vol.-rectification must both be co-existent in all rectifying crystals, or the whole phenomenon of rectification is only a surface effect. L. S. T.

Connexion between the energy constant ϵ and the quantity constant a in the conductivity–temperature formula for oxide semi-conductors. W. MEYER and H. NELDEL (Physikal. Z., 1937, **38**, 1014—1019).—The relationship between the consts. ϵ and a in the conductivity (σ) relationship $\sigma = ae^{-\epsilon/kT}$ has been investigated for WO_3, ZnO, UO_2, TiO_2, Fe_2O_3, Cr_2O_3, and U_3O_8. For those semi-conductors with $\sigma_{20°} \leq 10^{-2}\Omega^{-1}$ cm.$^{-1}$ (TiO_2, Fe_2O_3, ZnO) there is a linear relationship between ϵ and log a. For those with $\sigma_{20°} \geq 10^{-2}\Omega^{-1}$ cm.$^{-1}$, ϵ is very small compared with unity, and the exponential term does not greatly affect σ. To a first approximation $\sigma = a$. A. J. M.

Electrical conductivity of cuprous oxide. L. DUBAR (Ann. Physique, 1938, [xi], **9**, 5—104; cf. A., 1935, 1055; A., 1936, 779, 1050).—A detailed account of investigations previously reported, and a theoretical interpretation of results. N. M. B.

Mechanism of ionic conductivity in solid salts according to ideas of disarray. I. E. KOCH and C. WAGNER (Z. physikal. Chem., 1937, **B**, **38**, 295—324).—Theoretical. Modern concepts of disarray in crystals are discussed and a mathematical theory is developed to account for the ionic properties of crystals. Four limiting types of disarray are dealt with, viz., (1) cations between the lattices and vacant spaces in the cation part of the lattice; (2) anions between the lattices and vacant spaces in the anion part of the lattice; (3) anions and cations between the lattices; (4) vacant spaces in both the anion and cation parts of the lattice. The sp. conductivities of mixed crystals of AgCl–$PbCl_2$, AgCl–$CdCl_2$, and AgBr–$PbBr_2$ at 210—350° have been measured, and from the data the concns. and mobilities of individual centres of disarray, and energy consts. for the migration of the centres, have been calc. on the basis of the theory. C. R. H.

Dielectric polarisation and the form of the carbon dioxide molecule. K. L. RAMASWAMY (Proc. Indian Acad. Sci., 1937, **6**, **A**., 301—311).—

The dielectric polarisation of CO_2 is const. between 20° and 210°, indicating that the gas is non-polar and that the mol. is linear (cf. A., 1938, I, 63). F. J. L.

Measurement of the dielectric constant of solid substances by means of ponderomotive forces. D. Dobrzyński (Bull. Acad. Polonaise, 1937, **A**, 335—349; cf. A., 1938, I, 160).—The dispersion of the dielectric const. of quartz (disc) is determined. For 50 Hertz, $\epsilon_\perp = 4{\cdot}55$, $\epsilon_\parallel = 4{\cdot}66$; for 5 mega-Hertz $\epsilon_\perp = 4{\cdot}41$, $\epsilon_\parallel = 4{\cdot}58$, all $\pm 0{\cdot}20$. $\epsilon_\parallel$ and $\epsilon_\perp$ are the dielectric consts. parallel and perpendicular to the optic axis. The results are discussed in detail. F. J. L.

Temperature dependence of the dielectric properties of titanium and tin dioxides. C. Schusterius (Z. tech. Physik, 1935, **16**, 640—642; Chem. Zentr., 1936, i, 4538—4539).—The dielectric const. ϵ of pure TiO_2 for λ 90—1500 m. varies linearly with temp. between 20° and 120°. At high temp., TiO_2 tends to undergo reduction, and is readily contaminated by diffusion of impurities; ϵ then shows a high dispersion. ϵ for SnO_2 varies continuously with temp. J. S. A.

Dielectric constant and dielectric loss of solid hydrogen chloride in the neighbourhood of its transition point. G. Hettner, E. Hettner, and R. Pohlmann (Z. Physik, 1937, **108**, 45—54).—The discontinuity in ϵ for solid HCl at 99° K. is studied over a range of $\lambda\lambda$ (30—5000 m.), by means of a simple resonance method. Dispersion and dielectric loss occur below, and reach max. at, the transition point, and recede towards shorter $\lambda\lambda$ with rise in temp. L. G. G.

Dipole moments of some aliphatic compounds. J. M. Stevels (Rec. trav. chim., 1938, **57**, 108—116, cf. A., 1937, I, 601).—The mutual effect on the at. refraction of various H or halogen atoms in substituted methanes is correlated with the dipole moments of these compounds. The difference in moment between CH_3X and CHX_3 is attributed to an induction effect in the C·H dipoles and not to repulsion between the halogen atoms. This treatment is extended to the halogen derivatives of higher alkanes. K. W. P.

Series effect on the dipole moments of some alkyl halides. E. G. Cowley and J. R. Partington (Nature, 1937, **140**, 1100).—Re-determined vals. of the polarisations and dipole moments of five alkyl bromides and six alkyl iodides in C_6H_6 at 20° are recorded. The moments of the *n*-iodides increase as far as BuI and then remain const., whilst those of the *n*-bromides show no increase beyond PrBr. The moments of the iodides are slightly < those of the corresponding bromides. The Pr^β compounds have moments > those of Pr^α compounds. The polarisability of the polar group appears to be a factor of more importance than the magnitude of the principal dipole in determining the change of moment in these series. L. S. T.

Viscosity dispersion of dielectric constants of organic liquids. E. Plötze (Physikal. Z., 1937, **38**, 1014).—The variation of transition frequencies of the dielectric consts. of dil. solutions of polar org. substances in non-polar viscous solvents with concn. and temp. has been determined for $\lambda < 10$ cm. A. J. M.

Chemical war materials. VI. Dipole moments of eye-irritant materials (tear gases). H. Mohler with J. Sorge (Helv. Chim. Acta, 1938, **21**, 67—72).—From measurements on dil. solutions in C_6H_{14} or C_6H_6 the following dipole moments (in D.) have been determined: CH_2ClAc 2·36, CH_2BrAc 2·38, $CH_2Br{\cdot}COEt$ 2·33, CH_2ClBz 3·26, CH_2BrBz 3·11, CH_2PhBr 1·88, bromophenylacetonitrile 3·37, and p-$C_6H_4Me{\cdot}CH_2Br$ 2·07. J. W. S.

Application of the ray-displacement refractometer to the study of anomalous dispersion of didymium glass. K. Prosad and R. P. Gupta (Indian J. Physics, 1937, **11**, 339—342).—The refractive index of Dy glass is measured by means of the ray-displacement refractometer (cf. A., 1937, I, 330) using $\lambda\lambda$ 4157—6678 A. Absorption bands are observed at $\lambda\lambda$ 6580, 6407, 6100, 5842, 5265, and 5126 A.; the last two cannot be observed photographically. F. J. L.

Refractive dispersion of organic compounds. IX. Optical exaltation in unsaturated hydrocarbons containing conjugated double bonds. T. M. Lowry and C. B. Allsopp (Proc. Roy. Soc., 1937, **A**, **163**, 356—365).—Optical exaltation appears to be exhibited by a system of two conjugated double linkings when these form part of an open chain (*e.g.*, $\Delta^{\beta\delta}$-hexadiene) but not when they are built into a ring (*e.g.*, $\Delta^{1:3}$-*cyclo*hexadiene). The ultra-violet absorption bands of conjugated ring systems are displaced towards lower frequencies relative to those of the corresponding open-chain systems. G. D. P.

Variation of magnetic double refraction with temperature in acetone and certain acetic esters. J. B. Hawkes (Physical Rev., 1938, [ii], **53**, 84—90). Measurements of the Cotton–Mouton coeff. in the temp. range −60° to 40° for $COMe_2$, MeOAc, EtOAc, $Pr^\alpha OAc$, $Bu^\alpha OAc$, and *n*-amyl acetate give a relationship represented by a straight line with a slope of the same sign but of much larger val. than can be justified by mathematical theory. This is interpreted as indicating a mol. interaction in the liquid > that assumed by theory. In presence of a freshly cleaned Cu surface, $COMe_2$ shows a reversal of sign of the birefringence with decreasing temp. There is no discontinuity in the Cotton–Mouton coeff. for amyl acetate near the f.p. N. M. B.

Optical rotatory power of *l*-menthol in heavy methyl alcohol. E. Ogawa (Bull. Chem. Soc. Japan, 1937, **12**, 545—546).—$[\alpha]_D^{14\cdot4}$ for *l*-menthol in 27·5% heavy methyl alcohol, and in MeOH, are both $-48{\cdot}63° \pm 0{\cdot}03°$. A review of [α] data in H–D substitution suggests that the isotope effect on the asymmetry field is smaller in cyclic mols. I. McA.

Magnetic rotation with rapid changes of field. E. Bretscher (Helv. phys. Acta, 1936, **9**, 42—62; Chem. Zentr., 1936, i, 4536).—The Zeeman effect, and the magnetic rotation of the plane of polarised light in high-frequency magnetic fields in the neighbourhood of a spectral line, are influenced by the

frequency f of the field. In the region of transmission, the effects are independent of f. The effect is considered in relation to Allison's supposed "time lag" of the Faraday effect. J. S. A.

Kerr effect of some nitro-compounds. F. GABLER and P. SOKOB (Z. tech. Physik, 1937, **18**, 322—326; cf. A., 1936, 1322).—Kerr consts. at 20° and 5461 A. of $PhNO_2$ and *m*- and *o*-$C_6H_4Me{\cdot}NO_2$ are $4{\cdot}01 \times 10^{-5}$, $2{\cdot}27 \times 10^{-5}$, and $2{\cdot}00 \times 10^{-5}$ c.s.u., respectively. O. D. S.

Proposed simplified method of writing electronic formulæ. P. BAUMGARTEN (Ber., 1937, **70**, [*B*], 2500—2501).—It is proposed to replace the double dot by a dash, *e.g.*, $|\overline{Cl}|$ instead of $:\dot{\underset{\cdot\cdot}{Cl}}:$, the double and triple linkings being shown by two dashes, *e.g.*, $H|C|||C|H$. A single electron is indicated by a point. In certain cases retention of the dots is advocated, *e.g.*, for illustrating processes of dissociation $|\overline{Cl}:\overline{Cl}| \rightleftharpoons |\overline{Cl}^{\cdot} + \overline{Cl}|$. The semipolar double linking is indicated by an arrow-head directed towards the atom which provides no electron to the union, *e.g.*, $|C|\!\!\downarrow O|$. H. W.

Valencies of carbon. R. TRUCHET (Compt. rend., 1937, **203**, 1074—1076).—The C atom can exist in several forms of which the chief are the tetrahedral (in which all four valency electrons have the same function) and the plane (which occurs in all cases of double linkings and in which three valencies are of the tetrahedral and the fourth of a differing type). This scheme accounts for the displacement of the absorption bands on passing from saturated to ethylenic compounds, the proximity of the C atoms and the enhanced frequency of the valency vibrations on passage from the single to the double linking, the peculiar magnetic properties of ethylenic derivatives, the readiness of *cis–trans* isomerisations, and the special additive properties of the double linking. The C_6H_6 nucleus is thus a regular hexagon to the centre of which there is an arrangement of six electrons of the second type. The arrangement is of high symmetry, particularly stable, and magnetically neutral. The electrons do not belong to particular C atoms but form an ensemble which gives the mol. its characteristic properties. The *cyclo*tetraene mol. is not planar. H. W.

Polarities of covalent linkings. C. P. SMYTH (J. Amer. Chem. Soc., 1938, **60**, 183—189).—The dipole moments of several linkings have been calc. from the moments of the mols. containing them and from the mol. structure as determined by electron diffraction or other means. Graphical comparison of the moments of single linkings with the electronegativities of the elements involved shows approx. consistency, excepting the linkings between C and larger atoms, which have moments apparently greatly increased by induction. The moments of double and triple linkings are commonly increased by contributions from forms containing semipolar linkings. Mixed forms of semipolar linkings affected by resonance have moments between 2·4 and $3{\cdot}5 \times 10^{-18}$. The polarities of semipolar linkings lie between those of covalent and electrovalent linkings. E. S. H.

Graphitic oxide. U. HOFMANN and E. KÖNIG (Z. anorg. Chem., 1937, **234**, 311—336).—The acidic properties of graphitic oxide and its electrochemical behaviour have been studied. Reduction by N_2H_4,H_2O proceeds almost quantitatively to C, N_2, and H_2O. When measured under a liquid which does not cause swelling (xylene), ρ is in agreement with *X*-ray data. The acidic behaviour is not due to the presence of H_2SO_4 absorbed in the prep., and the amount of replaceable H is $\gg$ would correspond with the presence of CO_2H groups on the edges of the layer-planes. Possible explanations are that the fourth valencies of the C in the planes carry acidic OH, or more probably that by partial oxidation to CO and CO_2, "holes" have been produced in the layer-planes having edges carrying CO_2H. The electrochemical potential is that of the surface oxidation products and not of the O in the interior of the crystal. The name "graphitic oxide" is better than "graphitic acid," and the conclusions of Thiele (A., 1937, 1, 457) are criticised. F. J. G.

Werner complexes. Absorption and optical activity of double-nuclear cobalt compounds. J. P. MATHIEU (Bull. Soc. chim., 1938, [v], **5**, 105—113; cf. A., 1936, 551).—Curves of optical absorption, rotatory dispersion, and circular dichroism, determined as previously (A., 1936, 410), are recorded in the visible range for the binuclear active bridged *complexes* $Br_4\left[X<\begin{smallmatrix}NH_2\\O_2\end{smallmatrix}>X\right]$, $I_3\left[X<\begin{smallmatrix}NH\\O_2\end{smallmatrix}>X\right]$, $I_4\left[X<\begin{smallmatrix}NH_2\\OH\end{smallmatrix}>X\right]$, $Br_4\left[X<\begin{smallmatrix}NH_2\\NO_2\end{smallmatrix}>X\right]$, and $(NO_3)_3\left[X<\begin{smallmatrix}NH_2\\SO_4\end{smallmatrix}>X\right]$, where $X = Co\,en_2$. The results are discussed with reference to configurations, which are similar according to the chemical method and the solubility rule. I. McA.

Structure of cyameluric acid, hydromelonic acid, and related substances. L. PAULING and J. H. STURDIVANT (Proc. Nat. Acad. Sci., 1937, **23**, 615—620).—The stability of the cyameluric nucleus C_6N_7 is confirmed by a quantum-mechanical calculation of the resonance energy by the mol.-orbital method. Conjugation energies of various groups with both cyanuric and cyameluric nuclei are derived. Their similarity points to the existence of a series of cyameluric derivatives analogous to the cyanuric derivatives. N. M. B.

Bond character and interatomic distance. J. M. ROBERTSON (J.C.S., 1938, 131—138).—A lecture.

Assignment of vibrational frequencies to particular linkings with reference to methylacetylene and ethane. F. T. WALL (J. Amer. Chem. Soc., 1938, **60**, 71—73).—The fractions of the total potential energy contributed by the various linkings of CH:CMe and C_2H_6 have been calc. for each of the non-degenerate frequencies of the mols. These fractions are taken as a measure of the extent to which a given mode of vibration can be assigned to a particular type of linking. The so-called C·C single-linking frequencies are not pure C·C vibrations. E. S. H.

Energy of carbon atoms, energy of linkings, and reactivity of organic compounds. J. M. PAUSCHKIN (J. Phys. Chem. Russ., 1937, **10**, 468—

477).—Existing experimental data (cf. A., 1937, I, 15) are used to investigate the relation of energy of activation to energies of atoms and of the linkings between them. An equation for the calculation of energies of activation in homologous series has been derived. R. C.

Interaction of atoms and molecules with solid surfaces. X. Activation of adsorbed atoms by metallic electrons. J. E. LENNARD-JONES and E. T. GOODWIN. **XI. Dispersal of energy from an activated link.** J. E. LENNARD-JONES. **XII. Critical phenomena in a two-dimensional gas.** A. F. DEVONSHIRE (Proc. Roy. Soc., 1937, **A**, **163**, 101—127, 127—131, 132—138).—X. The conduction electrons form a reservoir from which an atom adsorbed on the surface of a metal can absorb energy. Calculations are made of the frequency with which excitation occurs by this mechanism, and also of the length of time before an atom loses energy to the metal by the same process.

XI. One atom of an infinite chain is assumed to bo set in motion and its rate of loss of energy is evaluated.

XII. The method previously used (A., 1938, I, 130) to find the equation of state of gases at large densities is applied to the two-dimensional case. It is found that the crit. temp. of a gas in two dimensions should be about half the crit. temp. of the same gas in three dimensions. G. D. P.

Modern methods of research in physics. P. DEBYE (Stahl u. Eisen, 1938, **58**, 1—8).—A lecture. Research work dealing with mol. and at. structure and with at. nuclei is discussed. A. K. G. T.

Molecular vibrations in deuterium compounds. E. BARTHOLOMÉ (Z. Electrochem., 1938, **44**, 15—20; cf. A., 1936, 782).—Theoretical. The isotope effect in D compounds and its application to the determination of the force consts. in these compounds are discussed. J. W. S.

Change in ionisation energy of an alkali atom by binding. J. H. DE BOER (Nederl. Tijd. Natuur., 1935, **2**, 273—288; Chem. Zentr., 1936, **i**, 4674).—A review of the effect in adsorbed Cs films. J. S. A.

Theoretical calculation of physical properties of certain crystals. J. A. WASASTJERNA (Soc. Sci. fenn. Comm. phys.-math., 1936, **8**, No. 21, 29 pp.; Chem. Zentr., 1936, i, 4402).—Lattice energy, zero-point energy, total energy, total heat of hydration, ionisation potentials, and mechanical properties of alkali halide type crystals are calc. theoretically. J. S. A.

Effect of structure of crystal lattice on thermal emission. B. MROWKA (Physikal. Z., 1937, **38**, 998—1000).—Theoretical. The crystal structure affects the emission work and the no. of states in the energy spectrum. A. J. M.

Effect of structure of crystal lattice on thermal emission. W. SCHOTTKY (Physikal. Z., 1937, **38**, 1024—1025).—The theory of Mrowka (see preceding abstract) is discussed. A. J. M.

Physics of solids. L. A. DUBRIDGE (Rev. Sci. Instr., 1938, [ii], **9**, 1—5).—A review of the properties of solids in the light of quantum-mechanical theories of energy levels. R. S. B.

Atomic forces of solid state. VII. W. WEN-PO (Phil. Mag., 1938, [vii], **25**, 111—129).—Mathematical. C. R. H.

Activation of nitrogen. Z. JOVITSCHISCH (Bull. Acad. Roy Serbe, 1936, **A**, No. 3, 113—118).—The direct combination of N with P and Hg is described. F. J. L.

Experiments with models on the degree of orientation of molecules in liquids and highly compressed gases. H. REHAAG and H. A. STUART (Physikal. Z., 1937, **38**, 1027—1031).—Small rectangular blocks of brass, representing the mols. of liquids, were shaken together, and their distribution was determined. The no. of almost exactly parallel groups of two particles is surprisingly large, and the perpendicular position is also favoured. A. J. M.

Kinetic theory of fluids. S. C. BRADFORD (Proc. Physical Soc., 1938, **50**, 30—62).—Mathematical. The kinetic theory is applied to real fluids by including the effect of mol. attraction. Observed properties are calc. dynamically from the attraction of ultimate particles, thermal agitation, and vol. only. Maxwell's law is modified with reference to the ratio of most probable mol. speeds in a fluid and ideal gas. Edser's inverse eighth power law of force is adopted in the application of results. The theory explains the observed decrease of η of liquids with temp. N. M. B.

Calculation of the van der Waals interaction for ions of the rare gas type with consideration of electronic interchange. T. NEUGEBAUER (Z. Physik, 1937, **107**, 785—794).—Van der Waals forces in crystals of the NaCl and CsCl types are calc. from the polarisability and the electron distribution in the ground state. It is shown that RbCl undergoes transformation from the NaCl to the CsCl type at lower temp., in agreement the experimental results of Wagner and Lippert. Close approximations for the van der Waals forces in the crystal lattice are difficult since the major part of the electron cloud lies outside the Goldschmidt ionic radius. H. C. G.

Determination of surface tension from refractive index. M. M. SAMIGIN (J. Phys. Chem. Russ., 1937, **10**, 455—457).—In a homologous series the parachor is a linear function of the mol. refractivity, and the surface tension can therefore be calc. from n. R. C.

Calculation of the surface tension of a liquid–vapour interface in terms of van der Waals force constants. R. H. FOWLER (Physica, 1938, **5**, 39—45).—Theoretical. Observed and calc. vals. are compared. H. J. E.

Condenser discharge *X*-ray tube. K. H. KINGDON and H. E. TANIS, jun. (Physical Rev., 1938, [ii], **53**, 128—134).—A tube giving reproducible high-intensity *X*-ray emission pulses is described, and photographic effect, coloration of crystals, and biological effects of these pulses are compared with the effects of *X*-rays of ordinary intensity from a Coolidge tube. N. M. B.

Determination of single-crystal *X*-ray diffraction patterns from two-crystal spectrometer rocking curves. F. MILLER, jun., and L. G. PARRATT (Physical Rev., 1938, [ii], **53**, 200).—Mathematical. N. M. B.

Intensities of *X*-ray reflexions from crystalline powders. G. W. BRINDLEY and F. W. SPIERS (Proc. Physical Soc., 1938, **50**, 17—29).—A crit. examination, with reference to applicability and accuracy, of the mixture and substitution methods of obtaining abs. measurements of intensities by comparison with reflexions from standard substances. Experimental results by the two methods for particles of different particle sizes are compared with Schäfer's theoretical results for the effect of particle size by the mixture method, and the agreement shows the utility of Schäfer's analysis in estimating the magnitude of the error if the mixture method is used for insufficiently fine particles. A special camera allowing an alternating interchange of powders with a corresponding movement of the photographic film in the substitution method is described. N. M. B.

Chemical linking by Fourier analysis. H. G. GRIMM, R. BRILL, C. HERMANN, and C. PETERS (Naturwiss., 1938, **26**, 29—31).—Fourier analysis has been used to discover finer differences in electron distributions in solids than hitherto. A two-dimensional projection of the electron density is made on suitable planes, and contours joining places of the same electron density measured in electrons per sq. A. Rock-salt, diamond, and $(CH_2)_6N_4$ were investigated, the projection being made on the (110) plane in the case of the first two. For NaCl the electron density is almost zero over a fairly wide area, whilst for diamond the min. vals. of electron density are 1·98 or 1·58 units. The difference between hetero- and homopolar linking is thus made clear by the diagrams. In the case of $(CH_2)_6N_4$ the projection was made on the (100) plane, but failed to reveal expected van der Waals linking. There is an increase of electron density at certain points indicating a chemical binding of the mols. with each other (possibly a type of H binding). This is in good agreement with physical and chemical properties of $(CH_2)_6N_4$. A. J. M.

***X*-Ray reflexion in disordered lattices.** W. BOAS (Z. Krist., 1937, **97**, 354—369).—Mathematical. For a periodic disarray in the normal lattice, comparative expressions are derived for line breadth and integrated and peak intensities, in terms of order (h) of reflexion and form and proportion of at. displacement. Line-broadening, and intensity effects for high h, are distinguished from those of random thermal motion. The smaller rise in lattice energy, different nature of intensity decrease with h, and asymmetric line-broadening found experimentally limit application in plastic deformation. I. McA.

Effect of geometrical arrangement of atoms on secondary electron emission. R. KOLLATH (Naturwiss., 1938, **26**, 60).—The secondary electron emission from Be films deposited by vaporisation on W, compact Be, Mo, and Ta showed a sudden increase at 750°, which is ascribed to a geometrical arrangement of Be atoms. A. J. M.

Atomic scattering factors of aluminium, potassium chloride, and copper for *X*-rays. G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1938, **50**, 96—107).—Abs. intensities of *X*-ray reflexions from powders standardised by reference to vals. for Al are consistently about 10% > those referred to KCl. New determinations of the scattering factors of KCl and Al, made by the powder method, confirm previous data for Al, but differ for KCl to an extent which explains the discrepancy. The theoretical scattering factors of K^+ and Cl^- are recalc. on the basis of Hartree's latest wave functions which make allowance for electron-exchange, and results show good agreement with the new measurements. The scattering factor of Cu^+ is calc. with and without allowance for electron-exchange and results are compared with experimental data for metallic Cu. N. M. B.

***X*-Ray diffraction in quartz.** G. W. FOX and J. R. FREDERICK (Physical Rev., 1938, [ii], **53**, 135—136; cf. A., 1935, 1059).—No difference in the intensity of the *X*-ray energies of the central beam or in the intensities of the $K\alpha_1$ and $K\beta_1$ lines of Ag after passing through *X*, *Y*, and *A* cut quartz plates non-oscillating and oscillating piezoelectrically was observed (cf. Jauncey, A., 1936, 1438). N. M. B.

Calculation of interplanar spacings of crystal systems by vectors. S. S. SIDHU (Indian J. Physics, 1937, **11**, 349—357). F. J. L.

Orientation of certain alkali halides by calcite. L. ROYER (Compt. rend., 1937, **205**, 1418—1420).—Crystals of NaBr, NaI, KCl, KBr, RbCl, RbBr, and KI, deposited from EtOH solution on a calcite cleavage face, are oriented with one cube face coincident with the p(100) face of the calcite, and the [100] edge parallel with the calcite [100] or [010] edge. The orientation is less marked with NaCl, and absent with NH_4I and RbI. The phenomenon is discussed. A. J. E. W.

Preparation of single-crystal wires of metals of high m.p. E. N. DA C. ANDRADE (Proc. Roy. Soc., 1937, **A**, **163**, 16—18).—The wire, enclosed in an evacuated tube, is heated by the passage of an electric current. A small auxiliary furnace outside the evacuated tube produces a temp. gradient in the wire. The crystal is grown either with a stationary temp. gradient and progressive cooling or by a travelling gradient produced by moving the auxiliary furnace. The former method has been successfully applied to Fe and the latter to Mo. G. D. P.

Regular growth of some alkali halides on sodium nitrate. W. HEINTZE (Z. Krist., 1937, **97**, 241—251; cf. Royer, A., 1934, 376).—For 9 salts, the growth of microcrystals on $NaNO_3$ is examined photomicrographically, method and solvent being varied. Crystal edges frequently grow parallel to one or other polar edge, or diagonal, of the rhombohedral $NaNO_3$ surface. Results are explained one-dimensionally by inductive superposition of lattice-lines of ions suitably spaced and charged. I. McA.

Orientation habit of martensite. A. B. GRENINGER and A. R. TROIANO (Nature, 1938, **141**, 38).—

In quenched plain high-C steels, martensite is not parallel to the octahedral {111} planes of the austenite lattice; the martensite plates are parallel to no low-indices plane of austenite. L. S. T.

Crystal chemistry of non-metallic inorganic compounds. F. MACHATSCHKI (Naturwiss., 1938, **26**, 67—77, 86—94).—A review of progress during 1927—1936.

Regular association of potassium permanganate and chlorate. H. E. BUCKLEY (Z. Krist., 1937, **97**, 370—385).—The parallel cryst. growths formed in various ways by $KClO_3$ and $KMnO_4$ are discussed from goniometric data and photomicrographs. Seifert's rule and criticism are met; in particular, the respective (001) are not parallel but inclined at 19·5°, and growths commonly conform to the rule: $[010]_{Mn}||[010]_{Cl}$, $(100)_{Mn}||(100)_{Cl}$. I. McA.

Evidence of abnormal behaviour of NO_3 in the cubic crystal $Ni(NO_3)_2,6NH_3$. S. H. YÜ (Nature, 1938, **141**, 158—159).—*X*-Ray examination shows that the behaviour of NO_3 in these crystals is abnormal. Diagrams of a possible structure, based on a space-group $F\bar{4}3m$, which allows for an abnormally large oscillation of NO_3 are submitted. L. S. T.

***X*-Ray analysis of barium aluminates.** S. WALLMARK and A. WESTGREN (Arkiv Kemi, Min., Geol., 1937, **12**, **B**, No. 35, 4 pp.).—The system $BaO-Al_2O_3$ shows two intermediate phases of composition BaO,Al_2O_3 (I), BaO,nAl_2O_3 ($5 < n < 7$) (II). (I) is hexagonal; a 5·209, c 8·761 A.; ρ 4·2; $2BaAl_2O_4$ per cell; space-group $D_6^2 - C6_32$. (II) is hexagonal with a 5·577, c 22·67 A.; like other aluminates and ferrites of bivalent metals, it is isomorphous with "β-alumina" $Na_2O,11Al_2O_3$ (cf. Beevers and Ross, A., 1938, I, 67). I. McA.

Crystal structure of alkali perrhenates and periodates. J. BEINTEMA (Z. Krist., 1937, **97**, 300—322).—From Laue and rotation photographs, the Na, NH_4, Rb salts, and $TlReO_4$ above 123°, are tetragonal, space-group $C_{4h}^6 - I4_1/a$, and the Cs salts and $TlReO_4$ (room temp.) are rhombic pseudo-tetragonal, space-group $D_{2h}^{16} - Pnma$. Cell consts. are given to 0·05% from precision powder *X*-radiograms. Neglecting O, at. parameters are deduced from Laue intensities, general considerations, and/or space-groups. Progressive departure from an "ideal cubic" scheelite structure in the above and other $A[BX_4]$ mols. is discussed in terms of c/a ratio, cation, deformation and polarisation of anion, and spatial mobility. $Ba(ReO_4)_2$ is monoclinic, a 12·19, b 12·44, c 7·33 A., β 90°; 4 mols. in cell. I. McA.

Crystal structure of cyanuric acid. E. H. WIEBENGA and N. F. MOERMAN (Nature, 1938, **141**, 122).—All atoms lie in planes giving the mol. the planar configuration expected from $OH\cdot C\begin{matrix}N\cdot C(OH)\\ N\cdot C(OH)\end{matrix}>N$. Determinations of at. parameters show the intermol. forces to be H linkages linking a N atom from one mol. to an O atom of another. L. S. T.

Cacodylates of zinc. II. Crystallographic study of zinc cacodylate heptahydrate. R. TIOLLAIS and L. BERTHOIS (Bull. Soc. chim., 1938, [v], **5**, 73—78).—$Zn(Me_2AsO_2)_2,7H_2O$ is monoclinic, $a:b:c = 1·1524:1:0·5214$. F. J. G.

Crystal structure of trithioformaldehyde, $(CH_2S)_3$. N. F. MOERMAN and E. H. WIEBENGA (Z. Krist., 1937, **97**, 323—331).—From *X*-ray analysis, the rhombic cell has a 7·63, b 7·00, c 5·25 A.; 2 mols. in cell; space-group $C_{2v}^7 - Pmn$; ρ 1·59. The 9 parameters chosen give a hexagonal "armchair" mol. with trigonal axis and symmetry plane, having C—S 1·75, 1·87 A., and valency angles 106°, 111°. Intermol. distances CH_2—S, CH_2—CH_2, S—S are ~3·6 A. The structure explains cleavage and estimated *X*-ray intensities, and is compared with that of $(CH_2O)_3$ (A., 1937, I, 225). I. McA.

Molecular shape and size of thymonucleic acid. R. SIGNER, T. CASPERSSON, and E. HAMMARSTEN (Nature, 1938, **141**, 122).—An investigation of the η and double refraction of flow of aq. Na thymonucleate shows that the mols. of this salt in solution have the form of thin rods the length of which is approx. 300 times the width; the mol. wt. of the prep. lies between 5×10^5 and 1×10^6, the mols. are optically negative, and the optical anisotropy is large. The macromol. must contain strongly double-refracting components arranged in a definite pattern. The purine and pyrimidine rings appear to lie in planes perpendicular to the longitudinal axis of the mol. L. S. T.

Formation and orientation of soft twinned crystals in anisotropic liquid drops of *p*-azoxyanisole. P. GAUBERT (Compt. rend., 1938, **206**, 62—64; cf. A., 1938, I, 69).—The formation of peculiar twinned crystals in drops of *p*-azoxyanisole sublimed on to mica sheets is attributed to the presence of impurities which are less sol. in the anisotropic than in the isotropic liquid, and are deposited from the former in directions governed by the cryst. planes of the mica face. A. J. E. W.

Surface structure of liquid mercury. G. L. J. BAILEY, S. FORDHAM, and J. T. TYSON (Proc. Physical Soc., 1938, **50**, 63—69).—An investigation of electron diffraction patterns for highly purified Hg surfaces and for surfaces contaminated by O_3 and by Hg halides and by the evaporation on to the surface of readily amalgamated films (Au, Ag) shows that the liquid Hg surfaces are in reality amorphous, but are generally covered with a thin cryst. film of some adventitious impurity of estimated thickness 9 A. N. M. B.

Bands in electron diffraction. H. BOERSCH (Physikal. Z., 1937, **38**, 1000—1004).—Rapid electrons scattered at single crystals give rise to Kikuchi bands as well as Laue points and Kikuchi lines. Bright or dark bands are observed according to experimental conditions. The bands were given by reflexion from all materials used (NaCl, KCl, PbS, $CaCO_3$, quartz, mica, diamond, Cu, Fe, etc.), and are independent of the angle of incidence. Their intensity depends on the perfection of the surface. Bands were also observed by transmission with mica. Two scattering processes take part in the production of the bands, which are discussed from the viewpoint of a general scattering with non-spherical angular distribution. When thin

single crystals of mica are irradiated with electrons bent lines are observed in addition to the above. A. J. M.

Structure of the $GeBr_4$ molecule. M. ROUAULT (Compt. rend., 1938, **206**, 51—52).—Electron diffraction measurements indicate a tetrahedral structure with the interat. distances Ge—Br 2·32 A., Br—Br 3·79 A. Pauling's at. radii give Ge—Br = 2·36 A. A. J. E. W.

X-Ray crystallographic and electron interferometric determination of the molecular structure of $C(CH_2X)_4$ (X = Cl, Br, I). O. HASSEL and L. C. STRÖMME (Z. physikal. Chem., 1937, **B**, **38**, 349—355).—The conclusions of Wagner and Dengel (cf. A., 1932, 564) and of de Laszlo (cf. A., 1934, 948) are criticised as a result of a repetition of their experiments. C. R. H.

Beilby layer. Structure and production of polished surfaces. J. ZERNIKE (Chem. Weckblad, 1938, **35**, 28—33).—A review. It is suggested that the experiments of Finch on the dissolving properties of the Beilby layer may have been vitiated by a layer of oxide or O, and that Dobinsky's work shows the existence of a special Beilby state, which may be responsible for the disappearance of phosphorescence of certain materials on grinding and for the photosensitivity of the AgI in the daguerreotype process. S. C.

Variations in the network of piezo-electric crystals produced by static electrical tension. V. DOLEJŠEK and M. JOHODA (Compt. rend., 1938, **206**, 113—115).—The influence of a static electrical field on the *X*-ray diffraction pattern of a quartz plate cut perpendicular to the electric axis has been shown to agree with theory. R. S. B.

Initial magnetisation. T. KAHAN (Ann. Physique, 1938, [xi], **9**, 105—176).—The ferromagnetic properties of Ni, Co, Fe, and Ni–Al alloy were investigated in weak fields where Rayleigh's law is obeyed. A new method of determining the demagnetising field is described. Results indicate that Rayleigh's law $k = a + bH$ is valid for each substance and that a relation exists between a and b and is a function of mechanical and thermal treatment and of impurities present in the specimens; the phenomena are to some extent modified by magnetostriction; Forrer's relation between n and the Curie point, n being given by $b = \text{const.} \times a^n$, is verified for Co. N. M. B.

Magnetic permeability at high frequencies of thin electrolytically-deposited layers of iron. S. PROCOPIU and G. D'ALBON (Compt. rend., 1937, **205**, 1373—1375).—Experiments with a Lecher wire system consisting of Cu wires with a thin surface layer of Fe show that μ decreases rapidly for layers of Fe <1000 mμ. thick, and becomes approx. unity for layers <35 mμ. thick. A. J. E. W.

Magnetic anisotropy in sheet steel. W. E. INGERSON and F. J. BECK, jun. (Rev. Sci. Instr., 1938, [ii], **9**, 31—35).—A method of measuring magnetic anisotropy is described and applied to the study of Si steel. R. S. B.

Four transverse magnetic effects in copper. E. H. HALL (Proc. Nat. Acad. Sci., 1937, **23**, 600—603).—A preliminary report of determinations of the coeffs. of the Hall, Ettingshausen, Nernst, and Righi–Leduc effects at 25°, 55°, and 85° is given. Results are discussed in relation to the Hall theory of electric and thermal conduction in metals. N. M. B.

Magnetic interaction in Heusler alloy. L. W. MCKEEHAN (Physical Rev., 1938, [ii], **53**, 199).—Quantities previously discussed (cf. A., 1937, I, 503) are evaluated from available data. N. M. B.

Permeability of permanent magnets. H. LACOSTE-TAYAN (Compt. rend., 1938, **206**, 103—105).—The demagnetisation factor of permanent magnets is studied and found to be dependent on the materials of construction in addition to geometrical form. R. S. B.

Temporal course of the magnetisation process in weak fields. H. WITTKE (Ann. Physik, 1938, [v], **31**, 97—115).—The variation in induction in an Fe ring during the first 1·8 sec. after reversal of the magnetising current has been followed and is interpreted. O. D. S.

Magnetic after-effect. H. WITTKE (Ann. Physik, 1938, [v], **31**, 187—192).—The results of Richter (B., 1937, 1059) are in agreement with the author's formula (cf. preceding abstract). O. D. S.

Computation of optical constants. J. B. NATHANSON (J. Opt. Soc. Amer., 1937, **27**, 393—394).—From the identity of optical consts. of metals as deduced from Fry's equation (cf. *ibid.*, 1932, **22**, 307) with those found by Drude's equation it is shown that the equations, though different in form, are identical. N. M. B.

Optical constants of rubidium and cæsium. H. E. IVES and H. B. BRIGGS (J. Opt. Soc. Amer., 1937, **27**, 395—400).—Investigations previously reported for K and Na (cf. A., 1937, I, 449) are extended to Rb and Cs. Full data and results are tabulated and plotted. N. M. B.

Optical constants of rhodium. M. AUWÄRTER (Z. tech. Physik, 1937, **18**, 457—459).—The reflecting power and transparency of thin Rh foils has been examined in the ultra-violet, visible, and infra-red. The substance is recommended for use as an optical mirror, and filter. Vals. of the optical consts. are unaffected by air and the vapours of acids or alkalis. There is a sudden decrease in the reflecting power at 450° owing to formation of Rh_2O_3. Rh shows no ageing with time or temp. No anomalies in the electrical resistance with variation of temp. up to 700° were found, and *X*-ray diagrams show no recrystallisation. A. J. M.

Structure and optics of evaporated metallic films. G. HASS (Ann. Physik, 1938, [v], **31**, 245—263; cf. A., 1937, I, 290).—The optical consts. of evaporated films of Ag, Sb, and Al have been measured in vac. by a polarisation method. They are dependent on the conditions of deposition of the films and deviate from vals. for the massive metals. The process of formation of a surface film on the metallic mirrors after entrance of air into the apparatus has been followed by the same method. O. D. S.

Elastic after-effect and its relation to optical after-effect. H. MUSSMANN (Ann. Physik, 1938, [v], **31**, 121—144).—For celluloid and glass up to the elastic limit and breaking point respectively, the elastic after-effect, *i.e.*, the change in extension or curvature between two fixed times after the removal of the load, $\propto$ the applied load. For celluloid up to the softening point the elastic after-effect $\propto$ temp. The optical after-effect in celluloid $\propto$ the applied load and $\propto$ the elastic after-effect. Results agree with the theory of Prandtl (Z. angew. Math. Mech., 1928, **8**, 85). O. D. S.

Variation of the elastic modulus of ferromagnetic substances with temperature and magnetic field. O. ENGLER (Ann. Physik, 1938, [v], **31**, 145—163).—The elastic moduli of Ni, Fe, Fe–Ni alloys, and Co have been measured at temp. from 0° to 425° and in magnetic fields up to 600 oersted. The ΔE effect (cf. Kersten, A., 1933, 1237) for Ni is max. at 125°. Results for Ni at low temp. agree with those of Nakamura (A., 1935, 816), and at high temp. agree, except for a const. numerical factor, with vals. derived from Kersten's theory (cf. *loc. cit.*). A temp. hysteresis was observed in the elastic modulus, the magnetisation, and susceptibility of Co at temp. in the neighbourhood of the allotropic transition. O. D. S.

Glide of single crystals of sodium and potassium. E. N. DA C. ANDRADE and L. C. TSIEN (Proc. Roy. Soc., 1937, **A**, **163**, 1—15).—A method of prep. of single-crystal rods of Na and K is described. An *X*-ray investigation shows that during plastic deformation slip occurs on a (123) plane in a [111] direction. The break up of more severely deformed crystals is described. G. D. P.

Glide of single crystals of molybdenum. L. C. TSIEN and Y. S. CHOW (Proc. Roy. Soc., 1937, **A**, **163**, 19—28).—Single-crystal wires of Mo have been subjected to deformation by tension at 20°, 300°, and 1000°. The direction of glide is always [111] but the glide plane is (112) at 20° and 300°, (110) at 1000°. G. D. P.

(A) Slip bands on mercury single crystals. (B) Critical shear stress of mercury single crystals. K. M. GREENLAND (Proc. Roy. Soc., 1937, **A**, **163**, 28—34, 34—53).—(A) A single-crystal wire of Hg which has not previously been stretched shows when subjected to tension slip bands which are branched and wavy. If the wire is slightly bent subsequent extension produces perfectly plane slip bands. The effect of torsion is also investigated. An examination of the surface suggests that it behaves as an elastic skin which does not break at the slip bands.

(B) The val. of the crit. shear stress for very pure Hg is 7·0 g. per mm.^{2} at −60°. This is increased to 28 g. per mm.^{2} by the addition of 0·1% Ag. Stress-strain curves are studied in detail and their form is discussed. G. D. P.

Physical basis of metal plasticity. H. SCHLECHTWEG (Tech. Mitt. Krupp, 1936, **4**, 29—38; Chem. Zentr., 1936, i, 4402—4403).—Theoretical. J. S. A.

Dynamics of plastic deformation. Naphthalene crystals. A. KOCHENDÖRFER (Z. Krist., 1937, **97**, 263—299).—Technique in prep. and axial orientation of single-crystal cylinders (65 × 6·8 mm.) of $C_{10}H_8$ are described. Slip systems are [010] (001) and [509] (010). For the former, longitudinal tension and pressure applied by Bausch's method (A., 1935, 435) yield no definite relation between load and deformation. Schmid's law is obeyed. Crit. stresses in extension and slip are 9·3 and 12—14 g. per mm.^{2} respectively. The limiting stress in vitreous fracture is 220 g. per mm.^{2} Using a Polanyi apparatus, the relations of flow velocity, stress, slip, tenacity, time, and recovery are examined and discussed. Slip phenomena are similar in metallic, ionic, and org. mol. lattices. I. McA.

Polymorphic transitions in ammonium nitrate. R. TIEMEYER (Z. Krist., 1937, **97**, 386—400; cf. A., 1936, 1450).—A fixed orientation of the original rhombic$_{II}$ crystal being maintained in a temp. series, nuclear growth and recrystallisation are studied, by Laue *X*-radiograms at various temp., in the transitions of NH_4NO_3. Grain size, mosaic disposition, and asterisms are noted. The transitions rhombic$_{II}$ $\overset{32\cdot5°}{\rightleftharpoons}$ rhombic$_I$ $\overset{84°}{\rightleftharpoons}$ tetragonal $\overset{125°}{\rightleftharpoons}$ cubic are confirmed. With temp. fall from above 125°, a metastable transition tetragonal (~50°) → rhombic$_{II}$ replaces the normal tetragonal (time-lag) → rhombic$_I$. I. McA.

Effective mol. wt. of vitreous boric oxide and silica. M. P. VOLAROVITSCH and A. A. LEONTEVA (J. Phys. Chem. Russ., 1937, **10**, 439—442).—Mol. wts. have been calc. from viscosity data by Sheppard and Houck's equation (A., 1930, 1244). The degree of association of SiO_2 rises rapidly as the temp. falls from 1380° to 1250°. Macleod's viscosity equation (A., 1936, 788) is not valid for vitreous B_2O_3. R. C.

Theory of ferromagnetism. I, II. L. OERTEL (Z. Physik, 1937, **107**, 746—757, 758—765).—Theoretical. L. G. G.

Interpretation of the paramagnetic Curie point of the elements of the rare-earth group. L. NÉEL (Compt. rend., 1938, **206**, 49—51; cf. A., 1937, I, 257).—The mol. fields of the rare-earth metals are due to interactions between electronic spins, not to orbital interactions. The interactions are of the exchange type occurring in metals of the Fe group. Vals. of the Curie points calc. on this basis are in accord with experiment. A. J. E. W.

Magnetic susceptibility of single crystals of thallium. S. S. RAO and A. S. NARAYANASWAMY (Current Sci., 1937, **6**, 276—277).—Addition of <2% of Pb causes an increase in the susceptibility of Th crystals perpendicular to the hexagonal axis (χ_1) and a considerable decrease in that parallel to this axis (χ_2). Bi produced a similar but greater effect. With addition of Sn χ_1 increased considerably and χ_2 decreased rapidly as [Sn] was increased. With approx. 1·5% of Sn the magnetic anisotropy was 1. Cold-working of single crystals of Th causes an increase in χ_1 and a decrease of χ_2. A. J. M.

Paramagnetism of the iron group. S. S. BHATNAGAR, M. L. KHANNA, and M. B. NEVGI (Phil. Mag., 1938, [vii], **25**, 234—241).—The susceptibilities of Co and Ni acetates, oxalates, and lactates, $Co(CNS)_2$, $Co(CN)_2$, Ni tartrate, citrate, and benzoate were determined. The p_B val. of Co^{++} is 4·97—5·37, except for $Co(CN)_2$, where it is 3·12, and of Ni^{++} 2·75—3·20. The results are compared with theoretical and experimental vals. of other workers. A. J. M.

Paramagnetic dispersion in iron alum. F. BRONS and C. J. GORTER (Physica, 1938, **5**, 60—64; cf. A., 1937, I, 452).—Additional data for Fe alum and data for a 1 : 4 Fe^{III}–Al^{III} alum are recorded. Much higher fields are needed to inhibit the susceptibility of the diluted Fe alum than for the pure Fe alum. H. J. E.

Thermomagnetic properties and constant paramagnetism of the UO_2^{++} ion in aqueous solutions of some uranyl salts. A. NICOLAU (Compt. rend., 1937, **205**, 654—656; cf. A., 1934, 596).—Vals. of ρ and χ for aq. solutions of $UO_2(NO_3)_2$ and UO_2SO_4, at 20—75°, are tabulated. χ remains const. over this temp. range, but decreases with increasing concn., probably owing to complex anion formation (cf. A., 1919, ii, 181). A. J. E. W.

Paramagnetic measurements at low fields with the Rankine balance. H. P. ISKENDERIAN (Physical Rev., 1937, [ii], **52**, 1244—1245; cf. A., 1937, I, 451).—The vol. magnetic susceptibilities of gaseous O_2 and aq. $NiCl_2$ solutions relative to H_2O were determined, and relative mass vals. are deduced. Assuming the mass susceptibility of H_2O to be $-0{\cdot}7200 \times 10^{-6}$, the val. found for O_2 is $104{\cdot}4 \times 10^{-6}$, and for $NiCl_2$ $33{\cdot}97 \times 10^{-6}$. N. M. B.

Magnetochemical investigations of organic compounds. XIII. Magnetic investigation of ωω′-phenylpolyenes. E. MÜLLER and I. DAMMERAU (Ber., 1937, **70**, [*B*], 2561—2565).—The magnetic susceptibilities of diphenyl-ethylene, m.p. 124°, -butadiene, m.p. 148°, -hexatriene, m.p. 202°, -octatetraene, m.p. 232°, and -decapentaene, m.p. 253°, and of tetraphenyl-ethylene, m.p. 221°, -butadiene, m.p. 203—204°, -hexatriene, m.p. 204—205°, -octatetraene, m.p. 200°, and -decapentaene, m.p. 227°, have been measured. Pascal's increment, $+5{\cdot}5 \times 10^{-6}$, is observed also in this series and from diene onwards the paramagnetic increment is const. at $+10{\cdot}6 \times 10^{-6}$. Measurements at the room temp. and at liquid air temp. show that the paramagnetic increment is independent of the temp. H. W.

Paramagnetism of the semiquinone of phenanthrenequinone-3-sulphonate. L. MICHAELIS, G. F. BOEKER, and R. K. REBER (J. Amer. Chem. Soc., 1938, **60**, 202—204).—Measurements of magnetic susceptibility confirm that the reduction of phenanthrenequinone-3-sulphonate by glucose passes through an intermediate stage represented in part by a free radical. The max. amount of the radical, detected by its paramagnetic properties, is formed at 50% reduction. E. S. H.

Paramagnetism of semiquinones. L. MICHAELIS, R. K. REBER, and J. A. KUCK (J. Amer. Chem. Soc., 1938, **60**, 214—215).—Magnetic susceptibility measurements show that the quinhydrone formed in acid solution, by reduction of phenanthrenequinone-3-sulphonate by methylglyoxal in presence of KCN, is a valency-saturated dimeric compound (cf. preceding abstract), thus confirming the results of potentiometric investigation (A., 1938, I, 31). E. S. H.

Polymorphism and magnetism of nickel and cobalt dithiocarbamates. L. MALATESTA (Gazzetta, 1937, **67**, 738—747).—Thermal analysis of various pairs of dithiocarbamates of Ni and of Cu shows that the corresponding compounds of the two metals are isomorphous. For each system the magnetic susceptibility shows complete additivity. The structures of the salts are discussed. O. J. W.

Transverse and longitudinal changes of resistance [in a magnetic field] of bivalent metals with space-centred cubic crystal structure. M. KOHLER (Physikal. Z., 1938, **39**, 9—23).—Theoretical. In the cases examined (magnetic field perpendicular to edge of cube and parallel to the cube diagonal, respectively) theory indicates that the transverse resistance change should be $\propto$ (field strength)^2 for strong fields, whilst the longitudinal resistance reaches a saturation max. For small fields or high temp. and therefore small resistance changes, the transverse and longitudinal effects are of the same order. The anisotropy ratio is independent of strength of field, temp. and impurities (if their concn. is small). The change of resistance is $\propto$ conductivity without the field. The experimental results of Justi *et al.* (A., 1936, 1452; 1938, I, 19) for W, although a sexavalent metal, agree fairly well with the above requirements. A. J. M.

Effect of tension on the electrical resistance of single tetragonal tin crystals. (MISS) M. ALLEN (Physical Rev., 1937, [ii], **52**, 1246—1249; cf. A., 1936, 416).—The adiabatic tension coeff. of resistance was determined for various orientations. The Cookson–Bridgman theory (cf. A., 1936, 1055) is extended to the tetragonal case and results agree with experiment. The dependence of the measured and the sp. tension coeffs. on primary and secondary orientation is contrary to that found for trigonal crystals. N. M. B.

Magnetic energy of superconductors. P. S. EPSTEIN (Proc. Nat. Acad. Sci., 1937, **23**, 604—610).—Mathematical. A derivation is given of Laue's hypothesis that a superconductor begins its transition to the normal state when the strongest part of the magnetic field H at its surface reaches the crit. val. H_c (H = field in presence of the superconductor). N. M. B.

Thomson effect of superconductive lead. J. G. DAUNT and K. MENDELSSOHN (Nature, 1938, **141**, 116).—No change in temp. occurred at a given point in a ring of superconducting Pb in which a temp. gradient was maintained, when the current was reversed, showing that the Thomson coeff. of Pb is $< 4 \times 10^{-10}$ v. per degree. It is suggested that, in general, electrons in a superconductive metal exchange thermal energy with the lattice, whereas those taking part in a persistent current do not. L. S. T.

Superconductivity. C. J. GORTER (Physical Rev., 1937, [ii], **52**, 1256—1257).—A discussion of the arguments of Wick (cf. A., 1937, I, 606) and London (cf. A., 1938, I, 19). N. M. B.

Experiments at radio-frequencies on superconductors. F. B. SILSBEE, F. G. BRICKWEDDE, and R. B. SCOTT (Nature, 1938, **141**, 75—76).—The magnetic field at the surface of an extruded Sn wire carrying an a.c. of a frequency of approx. 200 kilocycles per sec. superposed on a d.c. pulsates cyclically. At a temp. slightly < the transition temp., the pulsation in field tends to carry the material through the transition between the normal resisting and the superconducting states. Under these conditions the p.d. between the ends of the wire contains a component of twice the frequency of the a.c. At radio-frequencies up to 3000 kilocycles per sec. the transition temp. for Sn and Ta are the same for d.c. equal in magnitude to the root mean square of the high-frequency currents. Below the transition temp., these materials offered no detectable resistance to currents of these frequencies. L. S. T.

Thermo-electromotive forces of some superconductors in the neighbourhood of their transition points; influence of a magnetic field. W. H. KEESOM and C. J. MATTHIJS (Physica, 1938, **5**, 1—16).—Data are recorded for the thermo-e.m.f. (e) at 2—10° K. of Pb against a Ag alloy wire and against Sn, and of In against Pb. The thermo-e.m.f. between two superconductors is zero. The e–T curve is continuous at the transition point either with or without an applied magnetic field. At 1—2° above the transition point, e varies with the longitudinal magnetic field. H. J. E.

Measurement of the velocity of sound in liquids by a resonance method. C. SĂLCEANU (Compt. rend., 1937, **205**, 1219—1221).—Bungetzianu's method of measuring the velocity of sound (v) is discussed. Vals. of v at 20°, obtained using a frequency of 1528 cycles per sec., for H_2O and 16 org. liquids are recorded. A. J. E. W.

Detection of change of frequency of light by the Doppler effect in the deviation of light by ultrasonic waves. L. ALI (Helv. phys. Acta, 1936, **9**, 63—83; Chem. Zentr., 1936, i, 4669).—The predicted frequency change is found, the change in λ of the 2537 A. Hg line being $1{\cdot}6 \times 10^{-5}$ A. for waves of 7600 kilocycles. J. S. A.

Diffraction of light by supersonic waves in solids. N. S. N. NATH and H. MUELLER (Nature, 1938, **141**, 37). L. S. T.

Thermal properties of deuterium and its compounds. K. CLUSIUS (Z. Elektrochem., 1938, **44**, 21—30).—Thermal data for D_2, HD, and H_2 are tabulated and compared. Inorg. D compounds generally have a higher b.p. and lower m.p. and lower v.p. at the m.p. than the corresponding H compounds, but compounds which are associated in the liquid state have higher m.p. and higher v.p. at the m.p., whilst compounds associated in both the liquid and vapour states have higher v.p. and lower b.p. than the corresponding H compounds. Substitution of D for H in a CO_2H causes a decrease in m.p., but the substitution in other org. groups raises the m.p. The differences in entropy between various D and H compounds are calculated. J. W. S.

B.p. of water as a function of pressure. A. ZMACZYNSKI and A. BONHOURE (Compt. rend., 1937, **205**, 1222).—The authors' previous equation (A., 1929, 143) is corr. to $\theta = 57{\cdot}2587 + (79{\cdot}3722 \times 10^{-3})p - (35{\cdot}5273 \times 10^{-6})p^2 + (6{\cdot}6950 \times 10^{-9})p^3$, where θ is a temp. on the H_2 thermometer scale, and p is the corresponding pressure in mm. of Hg. A. J. E. W.

F.p. of pure hydrocarbons of the gasoline boiling range and of their binary mixtures. J. SMITTENBERG, H. HOOG, and R. A. HENKES (J. Amer. Chem. Soc., 1938, **60**, 17—22).—F.p. data recorded (and transition points, in parentheses) are: *n*-pentane, β-methylbutane, −129·7°, −160·6°; *n*-hexane, ββ- and βγ-dimethylbutane −95·5°, −100·5° (about −146°), −128·5° (about −142°); *n*-heptane, β-methylhexane, ββ-, βγ-, γγ-dimethylpentane, βγγ-trimethylbutane, −90·8°, −118·5°, −124·0°, −119·1°, −135·7°, −26·3° (about −156°); *n*-octane, βε-dimethylhexane, ββδ-trimethylpentane, γ-methyl-γ-ethylpentane, ββγγ-tetramethylbutane, −56·8°, −94·0°, −107·6°, −91·1°, 101·5° (−119·2°); *n*-nonane, −53·8°; ethyl*cyclo*butane, *cyclo*-, methyl*cyclo*-pentane, *cyclo*-, methyl*cyclo*-, *iso*propyl*cyclo*-hexane, −143·2°, −94·3° (−151·4°), −142·7°, 6·4° (−87·0°), −126·4°, −89·8°; C_6H_6, PhMe, $PhPr^{\beta}$, 5·5°, −95·6°, −96·2°. M.p. are recorded for some of the compounds. Glasses were formed on freezing by β- and γ-methylpentane, βγ-dimethylpentane, γ-methylheptane, βγ-dimethylhexane, γδ-dimethylhexane, and ββγ-trimethylpentane. F.p. diagrams of some of the binary mixtures have been determined. As a rule there is a eutectic point and the f.-p. curves of the components conform with the formula for the ideal f.-p. curve. *n*-Octane and *n*-nonane appear to form an interrupted series of mixed crystals, and ββγ-tri- and ββγγ-tetra-methylbutanes a continuous series. Glasses were produced in most of the binary *iso*paraffin mixtures. E. S. H.

Oscillations in the m.p. of members of homologous series. V. K. NIKIFOROV and I. I. KOROLKOV (J. Gen. Chem. Russ., 1937, **7**, 2139—2142).—The m.p. of members of homologous series of aliphatic hydrocarbons, carboxylic acids, alcohols, and ketones are given by $T = a + b \log (M - C - j)$, where T is abs. temp., a, b, and C are consts. for a given series, and $j = 0$ for substances with an even no. of C atoms, and 0—20 for those with an odd no. of C atoms. R. T.

Latent heat of vaporisation and molecular constitution. R. LAUTIÉ (Bull. Soc. chim., 1937, [v], **4**, 2076—2081).—Published data support the rule that in a homologous series the product of the latent heat of vaporisation and the square root of the parachor is const. E. S. H.

Latent heat of fusion. N. S. BINAYENDRA (Gazzetta, 1937, **67**, 714—715).—The latent heat of fusion, L, of an element is given approx. by $L = KP/V$, where P = parachor, V = at. vol., and K =

const. which depends on the nature of the lattice of the element. O. J. W.

Anomaly in specific heat of lithium. *X*-Ray investigation. G. PANKOW (Helv. phys. Acta, 1936, **9**, 87—122; Chem. Zentr., 1936, i, 4687).—The Debye characteristic temp. of Li, determined from measurements of at. lattice vibrations by means of the intensity of *X*-ray reflexion, agrees with that calc. from the electrical resistance, and shows no anomaly. J. S. A.

Fluorine at low temperatures. VIII. Determination of molecular heat, heat of fusion, and entropy of fluorine. E. KANDA (Bull. Chem. Soc. Japan, 1937, **12**, 511—520; cf. A., 1937, I, 607, 629; 1938, I, 63, 66).—Thermal analysis in the range −258° to −190°, using apparatus and method proved by determination of O_2 consts., yields for F_2 C_p–T curves and the following consts.: m.p. 55·20° K., b.p. 85·19° K., L_f 372 g.-cal., characteristic temp. Θ (Debye) 100·3, S_v at b.p. 37·29 units. I. McA.

Specific heat of fused sodium hydroxide. V. R. TERASCHKEVITSCH and A. N. VISCHNEVSKI (J. Gen. Chem. Russ., 1937, **7**, 2175—2182).—The mean C_p of NaOH at 22—597° is 0·518±0·006. R. T.

Physical properties of water and steam. J. HAVLIČEK and L. MIŠKOVSKÝ (Helv. phys. Acta, 1936, **9**, 161—207; Chem. Zentr., 1936, i, 4685).—Measurements of the heat content, sp. vol., and sp. heat of H_2O, saturated steam, and superheated steam up to 550° and 400 kg. per sq. cm. are described, and an equation of state is derived. J. S. A.

Molecular heat of methane in solid CH_4–Kr mixtures. Correction and addition. A. EUCKEN and H. VEITH (Z. physikal. Chem., 1937, **B**, **38**, 393—394).—The data previously obtained (cf. A., 1937, I, 74) are compatible with the intercombination curve for the heat of rotation of CH_4 as amended by Maue (cf. A., 1938, I, 14). C. R. H.

Thermal properties of vinyl bromide. A. GUYER, H. SCHÜTZE, and M. WEIDENMANN (Helv. Chim. Acta, 1938, **21**, 22; cf. A., 1937, I, 607).—Some of the results recorded previously are in accord with the results of Mehl (A., 1934, 952). J. W. S.

Tempering and annealing of boric anhydride glass. E. RENCKER (Compt. rend., 1937, **205**, 1396—1398; cf. A., 1938, I, 72).—The V/T curve of a specimen of B_2O_3 glass, obtained by allowing the specimen to attain const. vol. at each temp. investigated, consists of two straight lines intersecting at 207°. Annealing and tempering increases the vol. only if the annealing temp. is >207°, and the change in vol. reaches a const. max. at >280°. These phenomena are probably due to the existence of two forms of the glass, α, stable at <207°, and β, stable at >280°. A. J. E. W.

Density of liquid magnesium. H. GROTHE and C. MANGELSDORFF (Z. Metallk., 1937, **29**, 352—353).—Between 765° and 850° Mg has d $1·584 - 1·8 \times 10^{-4}(t - 675°)$. A. R. P.

Pyknometric precision method for liquids and solids. II. Density of pure toluene, calcspar, sodium chloride, magnesium, and aluminium at 0°. T. BATUECAS and F. L. CASADO (Z. physikal. Chem., 1937, **181**, 197—207; cf. A., 1936, 417).—The following vals. of d_4^0 have been determined by the method described previously; PhMe, 0·885482± 0·000003 g. per ml.; Iceland spar 2·71123±0·00011, NaCl 2·16756±0·00012, Mg 1·7407±0·0002, and Al 2·7015±0·0003 g. per c.c. From the results the lattice spacings in NaCl and $CaCO_3$ are calc. as $3·0276 \times 10^{-8}$ cm. and $2·8120 \times 10^{-8}$ cm., respectively, in accord with *X*-ray data. J. W. S.

Heat of evaporation, orthobaric densities, and critical data of aluminium bromide. D. I. SHURAVLEV (J. Phys. Chem. Russ., 1937, **10**, 325—329).—The sp. gr. of liquid and gaseous $AlBr_3$ is measured between 170° and 490°. For the Cailletet–Mathias diameter the equation $(d_L + d_G)/2 = 1·4594 - 0·1348t \times 10^{-2} + 0·389t^2 \times 10^{-6}$ is found. The calc. crit. data are $T_c = 495°$, $d_c = 0·887$, $p_c = 26·7$ atm. $AlBr_3$ is normal. J. J. B.

Tumlirz' equation for alcohol vapour. I. I. GODNEV, S. N. SOLODUSCHENKOV, and M. M. SOBOLEVA (Prom. Org. Chim., 1937, **4**, 566—567).—The sp. vol. v of EtOH vapour at pressure P (<5 atm.) is given by $v = RT/P - 0·290$. R. T.

Limit of superheating and resistance to tensile stress of liquids. W. DÖRING (Z. physikal. Chem., 1937, **B**, **38**, 292—294).—A correction (cf. A., 1937, I, 557). The pressure of a vapour in a gas bubble in a liquid is, for a given total pressure on the liquid, independent of the radius of curvature of the bubble. R. C.

Critical phenomena in gases. I. J. E. LENNARD-JONES and A. F. DEVONSHIRE (Proc. Roy. Soc., 1937, **A**, **163**, 53—70).—The methods of classical statistical mechanics are applied to derive an equation of state for gases at large densities. An atom of the gas is regarded as being confined to a cell so that its average environment approximates to that of an atom in a liquid or a crystal, and it is continually subject to a multiple encounter. The vals. of the crit. temp. of H_2, Ne, A, and N_2 calc. are in good agreement with observation. (Cf. A., 1938, I, 123.) G. D. P.

Variation with temperature of thermal conductivity and *X*-ray structure of some micas. I. Thermal conductivity up to 600°. R. W. POWELL and E. GRIFFITHS. **II. *X*-Ray examination of the structure.** W. A. WOOD (Proc. Roy. Soc., 1937, **A**, **163**, 189—198, 199—204).—I. The divided bar method is used. Phlogopite micas show a pronounced decrease of thermal conductivity at about 200°, which is only partly reversible on cooling. Muscovite micas do not show this effect.

II. *X*-Ray investigation shows that heat-treatment may produce marked mosaic formation without apparent change of external appearance, the change being partly reversible on cooling. The thermal expansion of the lattice is measured. The perfection of at. arrangement in the crystallites produced by breakdown of the large crystals is discussed. G. D. P.

Effect of temperature on the thermal conductivity and the accommodation coefficient of

hydrogen below 0°. H. S. GREGORY and E. H. DOCK (Phil. Mag., 1938, [vii], **25**, 129—147).—The dependence on temp. of heat conduction is satisfactorily expressed between 0° and −182° by the relation $K_T = 2{\cdot}14 \times 10^{-6} \times T^{0{\cdot}938}$ where K_T is the thermal conductivity at $T°$ K. The coeff. of accommodation, α, decreases from 0·48 at −182° to 0·23 at 0°. The dependence of α on temp. is discussed theoretically. The factor f, defined by Chapman's expression $f = K/\eta C_v$, has been calc. and compared with vals. calc. from semiempirical expressions of Eucken and of Jeans. Each method of calculation gives a val. approx. 2·0 over the temp. range studied except at the lowest temp., where f = approx. 2·3.

C. R. H.

Thermal conductivity of diamond and potassium chloride. W. J. DE HAAS and T. BIERMASZ (Physica, 1938, **5**, 47—53; cf. A., 1937, I, 506).—Data are recorded for the range 2—25° K. The thermal conductivity of KCl in this range depends on the thickness of the specimen examined and passes through a min. The val. for diamond at 10—20° K. shows an increase with decreasing temp. which $\propto T^{-2{\cdot}5}$.

H. J. E.

Wiedemann–Franz law for crystals of any crystal form. M. KOHLER (Ann. Physik, 1938, [v], **31**, 116—120; cf. A., 1936, 1329).—The Wiedemann–Franz law is valid for metal crystals of any form.

O. D. S.

Adiabatic and isothermal compressibilities of heavy water. S. BHAGAVANTAM and B. S. R. RAO (Nature, 1937, **140**, 1099).—The compressibility of 99·2% D_2O is nearly the same as that of H_2O, and, as in the case of H_2O, the ratio of the isothermal to the adiabatic compressibility is practically unity.

L. S. T.

Viscosity of liquid helium below the λ-point. P. KAPITZA (Nature, 1938, **141**, 74).—Measurements by a new method indicate that below the λ-point the η of He II is $\geqslant 1/1500$ that of He I at normal pressure. This may explain the abnormally high heat-conductivity of He II below the λ-point. It is suggested that below this point He enters a special "superfluid" state.

L. S. T.

Flow of liquid He II. J. F. ALLEN and A. D. MISENER (Nature, 1938, **141**, 75).—Data obtained from the flow of liquid He II through long capillaries are recorded and discussed. The flow of He II at 1° K. does not follow the ordinary equation for laminar or turbulent motion. The type of motion observed may arise from slipping of He II over the surface of the tube, in which cases the vals. obtained for η have little meaning. Undamped turbulent motion does not account for an appreciable part of the high thermal conductivity observed.

L. S. T.

Viscosity of air. P. J. RIGDEN (Nature, 1938, **141**, 82).—New measurements give $\eta_{17°} = (1800{\cdot}8 \pm 0{\cdot}7) \times 10^{-7}$ c.g.s., temp. coeff. $4{\cdot}93 \times 10^{-7}$ per degree, from which $\eta_{23°} = (1830{\cdot}3 \pm 0{\cdot}7) \times 10^{-7}$ c.g.s. Substitution of this val. in Millikan's data on the determination of e gives $e = (4{\cdot}800 \pm 0{\cdot}004) \times 10^{-10}$ e.s.u. in agreement with recent vals. from X-ray and electron diffraction methods (A., 1937, I, 441).

L. S. T.

Viscosity and chemical constitution. M. SOUDERS, jun. (J. Amer. Chem. Soc., 1938, **60**, 154—158).—Data for η and d for 117 org. liquids can be expressed by: $\log_{10}(\log_{10}\eta) = md - 2{\cdot}9$. The const. m is characteristic for each liquid and when multiplied by mol. wt. yields a viscosity-constitutional const., I. Vals. of at. and structural consts., from which I may be calc., are derived. The observed and calc. vals. of I for nearly all the liquids agree to <1%.

E. S. H.

Discussion on the viscosity of liquids. G. I. TAYLOR. J. D. BERNAL. A. S. C. LAWRENCE. E. N. DA C. ANDRADE. E. HATSCHEK. R. K. SCHOFIELD (Proc. Roy. Soc., 1937, **A**, **163**, 319—337).—A review of the present position and recent advances towards a theory of viscous flow.

G. D. P.

Viscosity of glass. III. P. GILARD, L. DUBRUL, G. HENRY, SCOHY, and PIERET (Bull. Soc. chim. Belg., 1937, **46**, 435—470).—The description (B., 1936, 594, 1040) of the experimental arrangements employed in a precision determination of η for glass is concluded with an account of the method of temp. measurement, and the procedure and results are exemplified by a specimen determination. Temp. gradients in the tubes in which thermocouples are mounted may introduce very serious errors. Pt|Pt–Re thermocouples are subject to the disadvantages that the thermoelectric force is variable in time, and that at temp. above 1000° they become brittle.

F. J. G.

Internal friction in solids. Thermoelastic internal friction. II. General theory. C. ZENER. **III. Experimental demonstration.** C. ZENER, W. OTIS, and R. NUCKOLLS (Physical Rev., 1938, [ii], **53**, 90—99, 100—101; cf. *ibid.*, 1937, [ii], **52**, 230).

N. M. B.

Attempt to detect the passage of helium through a crystal lattice at high temperatures. (LORD) RAYLEIGH (Proc. Roy. Soc., 1937, **A**, **163**, 376—380).—An experimental arrangement is described by means of which it is shown that, at 415°, a plate of mica 1 mm. thick and 1 cm.^{2} area transmits $<7 \times 10^{-5}$ mm.^{3} per day. This result is compared with that previously obtained for other materials, vitreous and cryst.

G. D. P.

Heat of mixing of liquids. III. Total and partial heats of mixing of normal liquids. IV. Heat of mixing of normal liquids when unstable molecular compounds are formed. V. KIREEV (J. Phys. Chem. Russ., 1937, **10**, 283—297, 298—312; cf. A., 1933, 561).—III. The heat of mixing is a function of three factors: (i) the difference between the internal pressures of the components, (ii) the deviation of van der Waals' a_{12} from $\sqrt{(a_1 a_2)}$, and (iii) the vol. change on mixing. Hildebrand's equation, which considers the first factor only, is incorrect.

IV. If the heat of mixing of normal liquids does not agree with the equation derived in (III), the formation of a mol. compound is probable. In some cases these compounds are known. In particular substances with a negative Kerr const. tend to form such compounds.

J. J. B.

Surface tensions of alcohol–water mixtures. S. VALENTINER and H. W. HOHLS (Z. Physik, 1937, **108**, 101—106).—γ is measured for MeOH– and EtOH–H_2O mixtures over the whole concn. range and between 20° and 50°. The temp. coeff–concn. relations are discussed. L. G. G.

Optical properties of Seignette and related salts. A. N. WINCHELL (Amer. Min., 1937, **22**, 1088—1093).—Data for the mixtures $NaKC_4H_4O_6,4H_2O$–$NaNH_4C_4H_4O_6,4H_2O$; $NaKC_4H_4O_6,4H_2O$–$NaNH_4C_4H_4O_6,4H_2O$–$KNH_4C_4H_4O_6,4H_2O$, and $NaRbC_4H_4O_6,4H_2O$–$NaKC_4H_4O_6,4H_2O$–$NaNH_4C_4H_4O_6,4H_2O$ are recorded and compared. L. S. T.

Isosteric and structurally similar compounds. V. Comparative investigations with substances R:NR′ and R:CHR′. H. ERLENMEYER and H. VON MEYENBURG (Helv. Chim. Acta, 1938, **21**, 108—111).—The formation of mixed crystals of nitrite and formate is readily explained by the assumption that CH and N are isosteric. The m.p. diagrams do not indicate the formation of mixed crystals in the cases of NPh_2·NO and NPh_2·CHO; NPhMe·NO and NPhMe·CHO; p-NMe_2·C_6H_4·CO_2H and p-$C_6H_4Pr^{\beta}$·CO_2H; $C_6H_4<^{N}_{NH}>N$ and $C_6H_4<^{N}_{NH}>CH$. H. W.

Metals and alloys. XXV. Constitution of the intermetallic phases $NaZn_{13}$, KZn_{13}, KCd_{13}, $RbCd_{13}$, and $CsCd_{13}$. E. ZINTL and W. HAUCKE (Z. Elektrochem., 1938, **44**, 104—111; cf. A., 1938, I, 24).—$RbCd_{13}$ and $CsCd_{13}$, prepared by heating the theoretical amounts of the pure components in evacuated tubes, have a cubic structure, with a 13·88 and 13·89 A., respectively. J. W. S.

Structure of binary alloys. R. BECKER (Z. Metallk., 1937, **29**, 245—249).—Expressions are derived for describing quantitatively the statics and dynamics of pptns. in simple binary alloys as functions of two energy magnitudes, viz., V the difference in the binding energy between similar and dissimilar neighbouring atoms, and Q the heat of activation which controls the diffusion process. A. R. P.

Superstructures in alloy systems. F. C. NIX (J. Appl. Physics, 1937, **8**, 783—794).—A summary. The measurement of the degree of order in alloy crystals and its bearing on electrical resistance and mechanical and magnetic properties are discussed. J. W. S.

Intermetallic compounds of the type Mg_2Sn. W. HUME-ROTHERY and G. V. RAYNOR (Phil. Mag., 1938, [vii], **25**, 335—339).—Mg_2Sn forms little or no ternary solid solution with Al or In although the composition was adjusted so as to give an electron concn. of approx. 8/3. Homogeneous alloys of the type $Mg[SnPb]_2$ could also not be prepared. The crystal structures of various intermetallic compounds containing Mg are discussed. In regard to the formation of ternary solid solutions of approx. const. electron concn. Mg_2Sn differs completely from the compounds formed in the case of Cu and Ag alloys. A. J. M.

Crystallo-chemistry of alloys. Section $MgZn_2$–$MgAg_2$. H. WITTE (Z. angew. Min., 1937, **1**, 83—92; cf. A., 1937, I, 23).—The recorded data include thermal observations, microscopic observations for melts containing up to 60 mol.-% $MgAg_2$, X-ray observations relating to 40 mol.-% $MgAg_2$ + 60 mol.-% $MgZn_2$ and 80 mol.-% $MgZn_2$ + 20 mol.-% $MgAg_2$, lattice consts. for alloys containing up to 45 mol.-% $MgAg_2$, and also the phase diagram. L. S. T.

Precipitation of the β-phase on tempering of an aluminium–magnesium alloy containing 12·7% of magnesium. R. MICHAUD (Compt. rend., 1937, **205**, 1399—1400).—Specimens of the alloy, hardened at 425°, were reheated to temp. θ, and examined by the Debye–Scherrer method. With $\theta \not> 200°$ a single phase represented by a supersaturated solution of Mg in Al is obtained. For $\theta = 200$—260°, two solid solutions (one supersaturated.) coexist, Mg being deposited as a β-phase. At $\theta = 260°$ pptn. of Mg is complete and a single solid solution occurs, but when $\theta > 260°$ the Mg previously deposited is dissolved and the normal solubility curve is obtained. A. J. E. W.

Diffusion and vapour pressure of zinc in brass. W. SEITH and W. KRAUSS (Z. Elektrochem., 1938, **44**, 98—102).—A method has been developed for measuring the v.p. of Zn or Cd in their alloys at high temp., and this has been applied to the measurement of the diffusion consts. of these metals in alloys with Cu and Ag at various temp. Diffusion is more rapid in the β-alloys than in the α-alloys. J. W. S.

Gold–aluminium system. A. S. COFFINBERRY and R. H. HULTGREN (Amer. Inst. Min. Met. Tech. Publ. 885, 1938, 10 pp.; Met. Tech. 1938, **5**, No. 1).—The equilibrium diagram has been examined between 300° and 500°. Although the authors' diagram differs considerably from that given by Hansen it is not in conflict with the experiments of Heycock and Neville. R. B. C.

Solid solubility of mercury in silver and in gold. H. M. DAY and C. H. MATHEWSON (Amer. Inst. Min. Met. Eng. Tech. Publ. 884, 1938, 20 pp.; Met. Tech., 1938, **5**, No. 1).—According to the results of X-ray analysis the solubility of Hg in Ag attains a max. val. of 52·4% Hg at 276° and thereafter falls gradually to 51·6% at 100°. The solubility of Hg in Au attains a max. val. of 18·75% Hg at 421°, decreases rapidly down to 300°, and thereafter very slowly to 15·7% at 100°. The curve is characterised by an inflexion at about 330°. X-Rays have also been used in the determination of the solidus curve for the system Ag–Hg over the range 276—560°. The results are in good agreement with the solubility data. R. B. C.

Interpretation, by means of models, of migration processes in metallic phases. C. WAGNER (Z. physikal. Chem., 1937, **B**, **38**, 325—348).—The models described facilitate the interpretation of the effects which are attributable to migration processes. C. R. H.

Spectrographic study of ternary lead alloys. R. BRECKPOT, J. CREFFIER, and O. PERLINGHI (Ann. Soc. Sci. Bruxelles, 1937, **57**, 295—305; cf.

A., 1937, I, 426).—The variation of intensity of lines due to Sn in the system Pb–Sb and of lines due to Sb on the system Pb–Sn has been studied for 0·3—3% Sn or Sb. Lines due to Sb and Sn in the metal–graphite arc, with the metal both as anode and cathode, have been similarly investigated. N. M. B.

System iron–manganese–silicon. R. VOGEL and H. BEDARFF (Arch. Eisenhüttenw., 1936—7, **10**, 581—586).—The system Fe–Mn–MnSi–FeSi has been examined by thermal and micrographic methods. There is one ternary compound $Fe_{12}Mn_5Si_{11}$ which forms pseudobinary systems with FeSi and with Mn_5Si_3; FeSi and MnSi form a similar system. The primary crystallites which separate as the temp. falls are ternary γ-Mn, ternary β-Mn, ternary γ-Fe, ternary α-Fe, FeSi, FeSi–MnSi solid solution, and Mn_5Si_3–$Fe_{12}Mn_5Si_{11}$ solid solution. There are four transition planes of solidification at 1120°, 1020°, 1010°, and 1160°, respectively, and two four-phase equilibria in the solid state at 720° and 1000°, respectively. Various sections through the ternary diagram and characteristic micrographs are included. A. R. P.

Conduction of electricity and diffusion in semi-metallic alloys ($Cu_{2-x}Se$). I. H. REINHOLD and H. MÖHRING. **II.** H. REINHOLD and H. SEIDEL (Z. physikal. Chem., 1937, **B**, **38**, 221—244, 245—269).—I. The sp. conductivity, κ, of the alloys $Cu_{2-x}Se$, where $x = 0·04$—$0·4$, has been measured at −180° to 350°. The temp. coeff. is negative, except at the lower temp., where there are complex hysteresis effects, possibly due to a third modification of Cu_2Se. The thermo-e.m.f. of $Pt|Cu_{2-x}Se$ at 0—350° has been determined. Both the direction of the e.m.f. of differential thermo-cells, $Cu_{2-x_1}Se|Cu_{2-x_2}Se$ and the variation with concn. of κ and the ionic mobility suggest deficiency-conduction by both electrons and $Cu^{\cdot}$ ions. It is inferred that the presence of excess of Se is to be explained by the occurrence of vacant positions in the partial lattice of the cations and of electron-deficiency points. The negative temp. coeff. and high val. of κ indicate that a considerable proportion of the electrons responsible for conduction are excess-electrons. Diffusivity measurements have been made.

II. A method of determining transport nos. of the order of 10^{-5} to 10^{-4} in semi-metallic alloys of non-stoicheiometric composition depends on measuring the coeff. of propagative diffusion, D, and the stationary concn. gradient established by electrolysis. In $Cu_{2-x}Se$ D is about ten times as large as the coeff. of self-diffusion, which may be explained by supposing that diffusion is caused, not only by the concn. difference, but also by an electric diffusion potential (cf. A., 1936, 792). Transport, conductivity, and diffusivity measurements and the Ludwig–Soret effect indicate that the $Cu^{\cdot}$ ions are freely mobile (cf. *ibid.*, 413). R. C.

Physico-chemical study of reactions between solids. Thermal analysis applied to isothermal transformations. Particular case of alloys (iron–carbon). R. CHATELET (Bull. Soc. chim., 1937, [v], **4**, 1996—2016).—The application of thermal analysis to the study of isothermal reactions in the solid state, particularly in alloy systems, is discussed on theoretical grounds and illustrated by observations on Fe-C alloys containing 0·1—0·9% of C. E. S. H.

***X*-Ray investigations in the system Mn–P.** O. ÅRSTAD and H. NOWOTNY (Z. physikal. Chem., 1937, **B**, **38**, 356—358).—In addition to MnP and Mn_2P, the existence of Mn_3P, isomorphous with Fe_3P, Cr_3P, and Ni_3P, has been demonstrated. No evidence for the existence of Mn_4P has been obtained. The lattice consts. for Mn_3P are a 9·160, c 4·599 A., and the space-group, by analogy with Fe_3P, is S_4^2. The consts. for Cr_3P (a $9·12_6$, c $4·56_0$ A.) and for Ni_3P (a $8·91_7$, c $4·39_0$ A.) have also been obtained. C. R. H.

Solubilities of gases and surface tension. H. H. UHLIG (J. Physical Chem., 1937, **41**, 1215—1225).—The expression $\log_e s = (-4\pi r^2\gamma + E)/kT$ is derived, in which s denotes the ratio of concn. of solute in the liquid to that in the gas phase, r is the radius of a solute mol., γ the surface tension of the solvent, E the interaction energy of solute and solvent, and k Boltzmann's const. For a given gas, the plot of $\log s$ with γ is linear, and the val. of E can be determined from the intercept. E is generally positive for large and negative for small s. Vals. of r calc. from the expression agree fairly with those calc. from other physical measurements. F. L. U.

Solubility of gases in metals. O. KUBASCHEWSKI (Z. Elektrochem., 1938, **44**, 152—167).—A review.

Solubility and colour of silver permanganate in heavy water. F. HEIN and G. BÄHR (Z. physikal. Chem., 1937, **B**, **38**, 270—274).—The solubility at 20° in H_2O is 0·0402 and in D_2O 0·0295 mol. per l. The extinction coeffs. of the saturated solutions at 450—750 mμ. have been measured. R. C.

Solubility influences. V. Influence of aliphatic alcohols on the solubility of ethyl acetate in water. D. G. BEECH and S. GLASSTONE (J.C.S., 1938, 67—73).—The three-component systems containing H_2O and EtOAc together with MeOH, EtOH, $Pr^{\alpha}OH$, $Pr^{\beta}OH$, $Bu^{\alpha}OH$, $Bu^{\beta}OH$, $Bu^{\gamma}OH$, and *sec.*-BuOH have been studied at 0° and 20°. Addition of small amounts of alcohols to H_2O decreases the solubility of EtOAc, especially at low temp., owing to the decrease of the activity of EtOAc in the ester layer through the presence of alcohol. The distribution ratio shows no such decrease when corr. for the activity change. The effect of the alcohol/H_2O ratio in the aq. layer on the corr. distribution ratio of EtOAc is compared for the various alcohols and discussed. At low alcohol concn. complex formation between EtOAc and H_2O, and its modification through depolymerisation of the H_2O, is the controlling factor, but with increasing concn. the relative areas of the non-polar and polar parts of the alcohol mols. and then their relative internal pressures become dominant factors. Complex formation between EtOAc and the alcohols has little influence on the solubility of EtOAc in aq.-alcoholic solutions. J. W. S.

Solubility of *d*-glutamic acid hydrochloride. T. K. SHIH (Ind. Res., China, 1935, **4**, 542—547).—

The solubility of the compound (I) in aq. HCl decreases with [HCl], particularly for <25% of HCl. NH_4Cl crystallises with (I) during its manufacture. The presence of degradation products of starch decreases the solubility of (I) in aq. HCl.

CH. ABS. (*e*)

Solubility and activity coefficient of silver iodate in potassium nitrate solutions. Standard potential of the silver–silver iodate electrode. I. M. KOLTHOFF and J. J. LINGANE (J. Physical Chem., 1938, **42**, 133—140).—Solubilities and activity coeffs. have been determined for various ionic strengths up to 1M. The activity product for $AgIO_3$ at 25° is $3{\cdot}04 \times 10^{-8}$. Saturated solutions of $AgIO_3$ in H_2O in glass vessels contain more IO_3' than $Ag^{\cdot}$, owing to cation exchange with the glass surface. The resulting error is eliminated by using paraffined glass. The standard potential of the electrode Ag–$AgIO_3$(solid)–IO_3' ($a = 1$) is $0{\cdot}3551 \pm 0{\cdot}0002$ v. at 25°. F. L. U.

Solubilities and activity coefficients of lanthanum iodate in concentrated salt solutions at 25°. J. N. PEARCE and W. C. OELKE (J. Physical Chem., 1938, **42**, 95—106).—Data are recorded for solutions of KCl, K_2SO_4, $MgCl_2$, and $MgSO_4$ from 0·001M to concns. approaching saturation. The salts increase the solubility of $La(IO_3)_3$ in the order $K_2SO_4 > MgSO_4 \gg MgCl_2 > KCl$. F. L. U.

Ageing of fresh precipitates. XVI. Distribution coefficient of chromate ions between barium sulphate and aqueous solutions. XVII. Equilibrium between mixed crystals of barium–lead sulphate and solutions. I. M. KOLTHOFF and G. E. NOPONEN (J. Amer. Chem. Soc., 1938, **60**, 39—41, 197—201; cf. A., 1937, I, 614).—XVI. The distribution coeff. K is 1·1 at 26° for 5—33 mol.-% of CrO_4'' in the solid phase; at 95° $K = 0{\cdot}38$ for 2—20 mol.-%. No equilibrium val. is obtained even after prolonged shaking when a SO_4''–CrO_4'' mixture is pptd. with $Ba(NO_3)_2$.

XVII. The distribution coeff. K of $Pb^{\cdot\cdot}$ between mixed crystals of $BaSO_4$ and $PbSO_4$ and aq. solutions is 0·0255 at 26° for 3—16 mol.-% of Pb in the solid phase; the temp. variation of K is small. The mixed crystals do not behave as ideal solid solutions. Distribution equilibrium is attained rapidly only at relatively high mol.-% of Pb and is accelerated by the addition of $HClO_4$. The val. of K is decreased by adding EtOH to the system, but is not affected by large amounts of $NaNO_3$ or $HClO_4$. E. S. H.

Theory of adsorption of mixtures of vapours. A. A. SHUCHOVITZKI (J. Phys. Chem. Russ., 1937, **10**, 412—417).—Polanyi's adsorption theory and the capillary condensation theory have been extended to the adsorption of binary mixtures of vapours and of dissolved substances. The two theories do not lead to the same results. Equations are derived permitting the calculation of the amounts of the components adsorbed from a mixture of any composition at any temp. from the isotherms for the adsorption of the pure components. R. C.

Calculation of adsorption isotherms of vapours on activated carbons. M. DUBININ and B. ONUSAITIS (J. Phys. Chem. Russ., 1937, **10**, 428—438).—The capillary condensation theory does not afford a general explanation of the sorption of vapours by activated C at all pressures. Kubelka's method for the empirical calculation of adsorption isotherms (A., 1931, 794) may be placed on a theoretical basis by means of Polanyi's potential theory of adsorption. Coeffs. characterising the curves for various vapours have been calc. A general method of calculating the adsorption isotherms of vapours at any temp. below the crit. temp. of the corresponding vapours is described. R. C.

Sorption of carbon dioxide by chlorophyll. E. RABINOWITCH (Nature, 1938, **141**, 39).—The sorption isothermals for 0° and −80° have been measured over the range 0 to 700 mm. Sorption is reversible and equilibrium is established rapidly. The heat of sorption is 2·6 kg.-cal. per mol., and saturation corresponds with 2 mol. of CO_2 per mol. of ethylchlorophyllide. Max. sorption corresponds with 1·1 mol. per mol. at −80°/600 mm.; at 0° and the partial pressure of CO_2 in air 1 mol. of ethylchlorophyllide in 15,000 carries a mol. of CO_2.

L. S. T.

Adsorption of the system acetic acid–water by blood charcoal. M. DOBINE (Compt. rend., 1937, **205**, 1388—1391; cf. A., 1925, ii, 657).—Experiments with undried C give an isotherm which rises to an approx. const. max. val.; dried C gives the S-shaped isotherm previously observed (A., 1914, ii, 542), owing to adsorption of H_2O. Allowing for the adsorbed H_2O, the adsorptive power of the C is unchanged by drying. A. J. E. W.

Particular kind of interaction of molecules in the adsorption layer. N. KOBOSEV and J. GOLDFELD (J. Phys. Chem. Russ., 1937, **10**, 261—278).—It is assumed that the adsorption of a mol. reduces the adsorption potential around it; this effect is equiv. to a mutual repulsion of adsorbed mols. Some consequences of this hypothesis are discussed. Measurements relative to the rate of adsorption and the isotherms have been made for the adsorption of propylene by Cu between −40° and 13° and between 10^{-5} and 10^{-2} mm. of Hg. The results agree with the theory if the "radius of interaction" of mols. is assumed to be approx. 2×10^{-7} cm. The adsorption of CO by Cu at 15° shows no interaction. J. J. B.

Sorption capacity of calcium carbonate. V. M. VOLOCHVIANSKI and G. D. SOBOLEVA (Nauch. Zapiski Sach. Prom., 1934, **11**, Book 54, No. 10, 35—40).—The adsorption capacity of $CaCO_3$ is increased when the compound is formed in presence of saponin. CH. ABS. (*e*)

Adsorption of constituents of a solid phase on the surface. S. DOBINSKI (Nature, 1938, **141**, 81—82).—The fact that the relative proportions of the elements in the scale formed on heating an alloy in air differ considerably, in most cases, from the average composition of the alloy is explained in terms of the differing surface tensions of the constituents. In any alloy, an element in the series Sb, Bi, Pb, Hg, Sn, Cd, Zn, Ag, Au, Cu, which corresponds with increasing surface tension, should tend to accumulate on the surface in preference to an element following it in the series. Since the surface tension

of the metals is > that of compounds or of non-metallic elements, the latter should also tend to displace the metals from the surface. When diffusion is accelerated by heating or by loosening the crystal structure by alternating stresses or polishing, the effect becomes prominent. The experiments described, in which metals etc. have been subjected to different treatments and the surfaces examined by electron diffraction, confirm these views. The corrosion-resistance of alloys at high temp., and the improvement which results from polishing, are interpreted on the basis of these relations. L. S. T.

Adsorption correction in the method of limiting densities. E. MOLES (Compt. rend., 1937, **205**, 1391—1393).—The use of the correction is illustrated and discussed. In accurate work its magnitude may considerably exceed the probable error of experiment. A. J. E. W.

Graphic representation of results of repeated extraction of cations from permutit. G. PAVLOVSCHI (An. Inst. Cercetări agronom. Românici, 1934, **6**, 276—291; Chem. Zentr., 1936, i, 4664—4665).—A graphical method for evaluating the total amount of exchangeable cations is described. J. S. A.

Liquid drops on liquid surfaces. T. H. HAZLEHURST and H. A. NEVILLE (J. Physical Chem., 1937, **41**, 1205—1214).—Examination of a no. of pure liquids shows that most are capable of forming drops on the surface of the bulk liquid, if a crit. height (H), through which the drop falls, is not exceeded. A table of H vals. is given. Drops do not persist ($H = 0$) for H_2O, HCO_2H, $(CH_2{\cdot}OH)_2$, CH_2Cl_2, glycerol, and diallyl ether. One liquid may form drops on a second liquid, but only when the two are closely similar; *e.g.*, MeOH on EtOH, but not on PrOH. Current explanations of the phenomenon are inadequate, and further possibilities are discussed. F. L. U.

Determination of contact angles and application to studies on wetting. E. KNEEN and W. W. BENTON (J. Physical Chem., 1937, **41**, 1195—1203).—The contact angle is directly measured on the enlarged shadow of a drop of liquid on a horizontal surface placed in a divergent beam of light. The vals. so obtained agree with those recorded in the literature. The method is used in determining the wetting power of various soap solutions for paraffin wax, and the wettability of leaves and tooth enamel. The contact angle of H_2O with cholesterol decreases rapidly with time of contact. F. L. U.

Surface tension at the boundary of two non-miscible liquids. V. C. BELCOT (Ber., 1938, **71**, [*B*], 52—59).—0·7% solutions of stearic (I), palmitic, and oleic acid in C_6H_6 are run into alkaline solutions of differing total dilution and differing ionic dilution and the surface tension, γ, is measured by counting the drops. This is found to be very great at the boundary of H_2O and C_6H_6. The same diminution of γ is observed with solutions of identical ion concn. but widely differing total concn. (NaOH, $NHEt_2$, NH_3). The most marked action on γ is exerted by (I); this depends on its colloidal nature, the orientation in the surface layer, and the solubility of the salts which are produced in H_2O. Only the OH ions and not the cations of the base influence γ. Neutralisation of the fatty acid in C_6H_6 by the base in H_2O gives rise to an active salt which diminishes γ at the zone of contact of the liquid phases; with a given acid the amount of salt formed at the zone of contact depends only on the OH′ content of the aq. solution. The experimental possibilities of (I) are considerably limited by its sparing solubility in C_6H_6 but its influence is considerable. In the depression of γ a min. is observed which is particularly marked with (I). This is due to the smaller solubility of the stearates and the necessity of a max. of γ for the formation of colloidal micelles. H. W.

Instantaneous detection of unimolecular films spread on mercury, by formation of a mist. M. DEVAUX (Compt. rend., 1937, **205**, 1343—1346).—Unimol. films of lipoidic liquids and solids on a clean Hg surface cause a pronounced "mist" when the surface is breathed on or exposed to air saturated with H_2O vapour. Hydrophilic substances give little or no mist under similar conditions. A. J. E. W.

Surface slit viscosimeter and the viscosity of monolayers. W. D. HARKINS and J. G. KIRKWOOD (Nature, 1938, **141**, 38—39).—A formula for the η of surface films flowing through a narrow slit is developed (cf. A., 1937, I, 562). L. S. T.

Behaviour of sodium glycocholate towards fatty acids and soaps. II. Behaviour towards different soaps. K. HOLWERDA (Biochem. Z., 1937, **295**, 11—28; cf. A., 1938, II, 46).—In aq. solutions containing Na glycocholate (I) and Na salts of fatty acids (C_8—C_{14}) γ decreases, and the stability of the foam increases, with increasing chain length, whilst in general max. foam stability and min. γ occur together at a particular concn. of (I). The properties of these systems are discussed with reference to the physico-chemical constitution of soap solutions. F. L. U.

Interaction between proteins and fatty acids on the surface of aqueous solutions. H. NEURATH (J. Physical Chem., 1938, **42**, 39—46; cf. A., 1936, 677).—In mixed films of ovalbumin (I) and myristic acid (II) on 0·1N-HCl there is no indication of interaction between the compounds when the mol. ratio (II)/(I) = R is >100. When R is <100 a marked increase in the area per mol. of (II) sets in, and reaches >180 sq. A. at $R = 9$. An explanation is offered. F. L. U.

Electrokinetics and surface chemistry. I. Electrophoresis of adsorbed ovalbumin. L. S. MOYER (J. Physical Chem., 1938, **42**, 71—83; cf. A., 1937, I, 615).—Mobilities of particles of SiO_2, glass, mineral oil, C, and collodion, immersed in a 0·5% solution of purified ovalbumin (I), have been measured at different p_H vals. In 0·02M-acetate or HCl–NaCl buffers the isoelectric point is at p_H 4·82, in agreement with Smith (A., 1935, 301). SiO_2 (negative) and Al_2O_3 (positive) give mobility–p_H curves of different slope when used as substrates, but the isoelectric point is unaffected. Surface-denatured (I) is isoelectric at p_H 5·02 when freely dispersed or adsorbed on SiO_2, and the mobility curves

are displaced from, but parallel to, those for native (I) on inert surfaces. F. L. U.

Influence of gelatin and electrolyte concentration on the ratio of electro-osmotic to electrophoretic mobility. H. L. WHITE and L. FOURT (J. Physical Chem., 1938, **42**, 29—37; cf. A., 1935, 933).—With Pyrex glass particles in a Pyrex cell, both gelatin-coated, the electro-osmotic mobility exceeds the catophoretic mobility at concns. of gelatin by $<0{\cdot}1\%$, the highest ratio (0·01% gelatin) being 1·77. The effect is also observed in presence of KCl at concns. $>10^{-3}$N. The glass is shown to be completely coated in 0·01% gelatin solutions. F. L. U.

Structure of double layer and behaviour in external electric field. A. J. RUTGERS (Chem. Weekblad, 1938, **35**, 67—69).—A discussion of results previously published (A., 1936, 1067, 1201). It is suggested that in electrophoresis the layer of counterions is continually restored by dissociation of H_2O mols. F. L. U.

Electrosmosis between plane parallel walls produced by high-frequency alternating currents. L. ROSENHEAD and J. C. P. MILLER (with note by J. J. BIKERMAN) (Proc. Roy. Soc., 1937, **A**, **163**, 298—317).—The problem of the motion of a fluid, between plane parallel walls, under the influence of a high-frequency a.c. is subjected to mathematical analysis. The appropriate equation of fluid flow is solved and it is inferred that the normal phenomena of electro-osmosis will be exhibited even when the frequency of alternation is as high as 10^5 per sec. G. D. P.

Capillary systems. XIX. 6. Permeability of coherent and compact material for gaseous and dissolved substances. E. MANEGOLD (Kolloid-Z., 1938, **82**, 26—36; cf. A., 1937, I, 612).—Theoretical. F. L. U.

Velocity of diffusion through a membrane. S. MIYAMOTO (J. Chem. Soc. Japan, 1936, **57**, 39—42).—Substances for which $D\sqrt{M}$ = const., where D is the diffusion const. and M the mol. wt., agree with the relation $\lambda\sqrt{M}$ = const., where λ is the permeability const. CH. ABS. (e)

Phenomena associated with movement of interface between two liquids in a porous diaphragm, and their utilisation for measuring the wetting of fibrous substances and powders, especially protein fibres. V. A. PTSCHELIN (J. Phys. Chem. Russ., 1937, **10**, 458—467).—In the displacement of one liquid from a porous body by another the rate of flow increases linearly with the pressure only when the latter is > a certain min. val. This deviation from Poiseuille's law varies in magnitude with the properties of the walls of the capillaries, and is ascribed to structural viscosity on the oriented film formed on the wall by that liquid which wets it. Displacement of the wetting by the non-wetting liquid begins only when the applied pressure is > a certain crit. val., p. The wettability of fibres or powders may be assessed by determining p, using a plug of the material, or by comparing the rates of flow through the plug of H_2O and a mixture ($d = 1$) of C_6H_6 and $CHCl_3$ under comparable conditions. Measurements have been made with various natural protein fibres. R. C.

Movement of materials across living membranes against concentration gradients. R. C. INGRAHAM, H. C. PETERS, and M. B. VISSCHER (J. Physical Chem., 1938, **42**, 141—150; cf. A., 1936, 1416).—The selective permeability of the small intestine to uni-univalent salts is discussed, and a physical mechanism is proposed. A formula based on the assumed mechanism is derived, and is shown to give vals. of the rate of absorption of NaCl which agree with observation. F. L. U.

Molecular solution volumes of optical isomers. T. S. PATTERSON and A. H. LAMBERTON (J.C.S., 1938, 123—124; cf. A., 1937, I, 513).—The criticism of Banks (A., 1938, I, 28) is fallacious, in that a large no. of observations were taken to reduce the error to a min. J. W. S.

Magnitude of the solvent effect in dipole moment measurements. I. Polarisation of carbon tetrachloride solutions. F. R. GOSS (J.C.S., 1937, 1915—1920).—For solutions of $PhNO_2$, PhCl, EtOBz, $COMe_2$, CH_2Cl_2, and Et_2O in CCl_4 the variation in the partial molar polarisations (P_2), obtained from the polarisations of the mixtures by the method of intercepts (A., 1933, 19), can be expressed by $P_2 = P_{E+A} + Z(\epsilon+1)^4/(\epsilon+2)^4 + Y/\epsilon$, where Y and Z are molar quantities the ratios (Y/P_0 and Z/P_{E+A}) of which to the orientation and distortion polarisations are a measure of the modification of the polarisation by anisotropy. These quantities are related by the formula $(Y/P_0 + 1)/[\sqrt[4]{\{(Z + P_{E+A})/P_{E+A}\}} - 1] = 3{\cdot}25$. The vals. obtained for the dipole moments of the compounds, after application of these formulæ, are in accord with the vals. deduced from measurements on the vapours. J. W. S.

Diamagnetism of the differently-coloured solutions of iodine. C. COURTY (Bull. Soc. chim., 1938, [v], **5**, 84—91).—A detailed account of work already noted (A., 1937, I, 302, 459). F. J. G.

Volume change on mixing aqueous solutions of electrolytes. I. UHARA (J. Chem. Soc. Japan, 1936, **57**, 53—58).—A discussion based on the theory of electrostriction. CH. ABS. (e)

Polarisation of light scattered by molecules of aqueous solutions of electrolytes. K. HOGREBE (Physikal. Z., 1938, **39**, 23—36).—The degree of polarisation of light scattered in aq. solutions of the chlorides, sulphates, and nitrates of Na, K, and NH_4 has been determined. The degree of polarisation remains practically const. with increasing concn. for solutions of the chlorides and sulphates. This is not the case for the nitrates owing to the anisotropy of NO_3'. A. J. M.

Influence of strong electrolytes on the dielectric constant of water. A. BLICHER (J. Phys. Radium, 1937, [vii], **8**, 505—511).—Using a resonance method and special precautions to ensure a const. electromagnetic field, data are tabulated for various electrolytes of the same sp. conductivity. Results are in good agreement with calc. vals. N. M. B.

Magnetic investigations of metallic solutions of sodium in ammonia. E. HUSTER and E. VOGT (Physikal. Z., 1937, **38**, 1004—1006).—The magnetic properties of solutions ranging from conc. solutions showing metallic conduction to dil. solutions showing electrolytic conduction have been examined. Conc. metallic solutions are diamagnetic. There is a transition from the weak paramagnetism of the degenerate Na electrons to a strong normal paramagnetism in very dil. solutions. Diamagnetism found at medium concns. is ascribed to the presence of Na_2. A. J. M.

Electrical properties of aërosols. D. BEISCHER (Z. Ver. deut. Ing., Verfahrenstech., 1937, 90—93).—The methods involved in the production of charged vapour particles, and the properties exhibited by the charged particles, are reviewed. R. B. C.

Peptisation and stabilisation of mineral dusts. K. SAMOCHVALOV (J. Phys. Chem. Russ., 1937, **10**, 489—494; cf. A., 1937, I, 180).—The stabilisation and peptisation of air suspensions of MgO, apatite, and nepheline by H_2O, octyl alcohol, oleic acid, and C_6H_6 vapours have been examined. There is a parallelism between the stabilising action and the dipole moment of the stabiliser. If the vapour of a substance with high dipole moment is introduced into a non-polar medium such as air, the polar substance undergoes oriented adsorption on the dispersed particles and so stabilises the dispersion. R. C.

Highly polymerised compounds. CLXXXIII. Polydispersity and multimolecularity. G. V. SCHULZ (Z. Elektrochem., 1938, **44**, 102—104).—Distinction is drawn between polydisperse and multimol. states. The latter term is restricted to substances of high mol. wt., whilst the former applies to colloidal solutions containing particles of various dimensions, and therefore includes multimol. systems (polystyrenes etc.). J. W. S.

Colloidal sulphur prepared by decomposition of aqueous hydrogen sulphide, and its reaction with colloidal mercury. N. SATA (Bull. Chem. Soc. Japan, 1937, **12**, 536—544; cf. A., 1936, 1460).—S sols have been prepared by heating narrow-necked containers above the liquid. The stability of the sols (i) after exposure to ultrasonic radiation for 1 min., (ii) after boiling for 2 min., and (iii) after successive application of (ii) and (i) has been compared with that of the original sols. The behaviour of the sols towards colloidal Hg is described. I. McA.

Colloid formation and electrophoretic phenomena on metals. L. I. BELIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 103—106).—The artificial formation of films and coatings by the immersion of Cu, Ag, or Fe in Au or Prussian-blue sols, and the effect of these films on the electrophoretic phenomena at a metal–liquid interface, are described. K. S.

Rapid determination of the gold content of gold sols. S. W. PENNYCUICK and C. E. WOOLCOCK (Austral. J. Exp. Biol., 1937, **15**, 423—428).—A simplified method of measuring the Au content of Au sols is described which involves the direct titration of the sol with KCN. The method appears to be applicable to all Au sols, and has been tested on neutral and alkaline Bredig sol, and sols reduced by P, tannin, and CH_2O. D. M. N.

London–van der Waals forces in colloidal systems. H. C. HAMAKER (Rec. trav. chim., 1938, **57**, 61—72; cf. A., 1938, I, 14).—These forces are discussed in relation to the long-range attraction between colloidal particles on the assumption that the forces depend on the diameter and the distance between the particles. The distance at which the potential energy corresponding with these forces is equal to the kinetic energy of the Brownian motion is defined as the range, and is normally 0·06—0·5 times the diameter of the smallest particle, whereas the size of the second particle is relatively unimportant. Definitions of range for larger particles are also discussed and it is shown that the concept of range will depend on the size of the particles. K. W. P.

Dielectric constant and particle size. Chlorinated rubber solutions. N. M. LI and J. W. WILLIAMS (J. Physical Chem., 1937, **41**, 1171—1181).—An attempt is made to calculate the particle size of chlorinated rubber (Cl 59—66%) dissolved in C_6H_6 and in CCl_4 from measurements of ϵ at different frequencies ($\lambda\lambda$ 17—600 m.). At moderate concns. there is evidence of polarisation due to rotation of macromols. about their long axes. The mol. wt. calc. from the dispersion of ϵ is of the same order of magnitude as that calc. from diffusion data. An additional polarisation contribution to ϵ is ascribed to the restricted rotation of recurring groups within the macromol., but no dispersion of this contribution could be detected. The dipole moment of the chlorinated rubber unit is about 12×10^{-18} e.s.u. F. L. U.

Variation of the internal friction of lyophilic colloids. I. Some properties of concentrated lyophilic emulsions and suspensions. C. ROSSI (Gazzetta, 1937, **67**, 691—708).—Measurements of the internal friction of vaseline oil and bitumen emulsions and also bentonite suspensions by means of a rotating-cylinder viscosimeter have been made. In some cases the mean internal friction, π, obeys the relationship $\pi = \pi_\infty + K/\Omega$, where π_∞ is the val. of π for very large vals. of Ω (the no. of revolutions per min. of the outer cylinder) and K is a const. For the vaseline oil emulsions K approaches a const. val. for large vals. of Ω. O. J. W.

Depolarisation of light transmitted by colloidal solutions. A. BOUTARIC and L. BERNARD (Ann. Soc. Sci. Bruxelles, 1937, **57**, 284—290).—Data are presented for colloidal solutions of As_2S_3, Fe_2O_3, and clay, flocculated by the addition of electrolytes. The connexion between the degree of depolarisation and the progress of flocculation is discussed. N. M. B.

Dynamic birefringence of colloids (Maxwell effect). Influence of solvent. G. SADRON (J. Phys. Radium, 1937, [vii], **8**, 481—488).—Mathematical. The birefringence of particles having the form of ellipsoids of revolution suspended in a liquid is calc. by Langevin's method; it can be expressed as

the sum of two terms which depend on the optical and geometrical anisotropy, respectively, of the particle. Results are given for a no. of org. solutions and show good agreement with experiment. The inversion of sign of the Maxwell effect for certain solutions is explained. N. M. B.

Stability of colloidal solutions. H. R. KRUYT (Bull. Soc. chim., 1937, [v], **4**, 1925—1941).—A lecture.

Two possible orientations of colloidal gœthite in a magnetic field. (MLLES.) W. HELLER and G. QUIMFE (Compt. rend., 1938, **206**, 64—66; cf. A., 1933, 461).—The change of sign of the magneto-optical anisotropy of colloidal α-FeO·OH which occurs on change of temp. is due to a change in the orientation of the particles. The optical anisotropy shows only slight variations with temp. A. J. E. W.

Influence of the orientation of non-spherical colloidal particles on their velocity of aggregation. (MLLES.) W. HELLER and G. QUIMFE (Compt. rend., 1937, **205**, 1394—1396; cf. A., 1938, I, 28, 30).—The rate of coagulation of a thixotropic α-FeO·OH sol has been found to increase appreciably on the application of a magnetic field of 27,600 gauss. The effect is attributed to orientation of the particles, which facilitates ordered coagulation. A. J. E. W.

Potential curves as a basis for the discussion of colloid phenomena. H. C. HAMAKER (Chem. Weekblad, 1938, 35, 47—55).—A review and discussion of work previously published (A., 1937, I, 78, 409). F. L. U.

[Hydrophobic colloids.] Influence of Brownian movement on potential curves. H. DE BRUIJN (Chem. Weekblad, 1938, **35**, 56—57; cf. preceding abstract).—Calculation of the difference of potential energy between parallel and anti-parallel moving pairs of particles shows a probability in favour of parallel motion. The effect of this on the attraction potential curve is considered. F. L. U.

Double layer and stability of lyophobic colloids. E. W. J. VERWEY (Chem. Weekblad, 1938, **35**, 70—78).—A general discussion (cf. A., 1936, 286, 934, 1067). F. L. U.

Counter ion exchange with lyophobic colloids. H. J. C. TENDELOO (Chem. Weekblad, 1938, **35**, 79—87).—A discussion of base exchange in clays (cf. A., 1935, 32, 930; B., 1936, 834). F. L. U.

Hydrophobic colloids. H. R. KRUYT (Chem. Weekblad, 1938, **35**, 44—47).—The properties of the electric double layer are discussed. F. L. U.

Absorption and scattering of light in hydrophobic colloids. II. Experimental test of Mie's theory. F. B. GRIBNAU (Kolloid-Z., 1938, **82**, 15—23; cf. A., 1937, I, 78).—Extinction coeffs. of sols of Au, Se, and mastic have been measured in the range λλ 4500—7000 A. The results agree with those calc. from Mie's theory. When strict precautions are used, Au and Se sols of a given dispersity are reproducible, provided the dispersity is not too low. Absorption by multidisperse sols of Au and Se prepared by mixing unidisperse sols is additive and agrees with theory. There is evidence that the absorption curves for colloidal Se merge continuously into that for Se in true solution. F. L. U.

Chemistry of colloid–colloid reactions. VI. Mechanism of protective action of higher carbohydrates. W. PAULI and W. KITAJ (Kolloid-Z., 1938, **82**, 43—58; cf. A., 1934, 598).—The protective action of gum arabic (I) and dextrin (II) on sols of Sb_2S_3 and FeO·OH has been studied by coagulation experiments with the sols alone, and in the presence of coagulating ions, $K^{\cdot}$, $Ba^{\cdot\cdot}$, $La^{\cdot\cdot\cdot}$, and Cl', SO_4'', $[Fe(CN)_6]'''$. Protection of Sb_2S_3 is observed at about the same concn., 5×10^{-5}%, of (I) and (II), and is complete at 0·01—0·1%. With FeO·OH much higher concns. are needed for protection, and a sensitising effect towards electrolytes is shown by (I) but not by (II). Reversible coagulation in the absence of electrolytes is also observed. The results are explained with reference to the physico-chemical constitution of the protective colloids. F. L. U.

Liesegang rings in non-gelatinous media. III. V. GORE (Kolloid-Z., 1938, **82**, 79—87; cf. A., 1936, 1338).—Liesegang rings have been obtained with HgI_2, Ag_2CrO_4, and AgBr in the presence of ungelatinised starch, and with these and other insol. salts in a large no. of inorg. colloidal solutions. F. L. U.

Liesegang rings from uric acid. H. KNÖLL (Kolloid-Z., 1938, **82**, 76—79).—Liesegang rings are developed when HCl diffuses into gelatin containing Na urate. The rings are gradually broken up by the growth of crystals. F. L. U.

Variations in viscosity of cellulose nitrate sols. A. A. MOROZOV and A. V. PAMFILOV (J. Gen. Chem. Russ., 1937, **7**, 2154—2166).—The η of $COMe_2$ sols of cellulose nitrate does not vary with time in those cases in which structural η is absent. Where this is present, the general η falls with time, as a result of disappearance of the structure of the sols, but not of depolymerisation. R. T.

Dielectric investigations on cellulose derivatives in organic liquids. VIII. Effect of temperature on the dipole moments of the acetates of cellulose, cellobiose, and glucose. IX. Comparison of the dielectric properties of the triacetates of starch and cellulose. X. Benzene solutions of tribenzylcellulose. XI. Benzene solutions of cellulose tripalmitate. S. LEE and I. SAKURADA (J. Soc. Chem. Ind. Japan, 1937, **40**, 425—426B).—VIII. In solution in C_6H_6 or $CHCl_3$ the dipole moments of all three substances increase with rising temp.; this is ascribed to the restricted rotation of the Ac groups. The effect of temp. on the moments of ethyl- and benzyl-cellulose is now ascribed to restricted rotation of the alkyl groups.

IX. At all the temp. used the dipole moments of the triacetates of starch and cellulose are the same when expressed in terms of the C_6 unit. This is probably due to the moment of each thread mol. being the same as that of the C_6 unit.

X. The dipole moment of tribenzylcellulose is > that of dibenzylcellulose and increases with rising temp.

XI. The dipole moment of cellulose tripalmitate is only slightly > that of the triacetate, and increases with rising temp. A. G.

Chromatography of cellulose acetates. G. R. LEVI and A. GIERA (Gazzetta, 1937, **67**, 719—723).—Investigation by means of the chromatographic technique shows that cellulose diacetate is fractionally adsorbed from solution by animal charcoal. The adsorption is greatest with the least viscous mols. With cellulose triacetate the adsorption is of the same order of magnitude, but in this case it is not accompanied by fractionation. It would seem that pure α-cellulose is not a mixture of mols. differing in size or in the degree of polymerisation. O. J. W.

Action of calcium oxide on cellulose acetate solutions. S. PAPKOV (J. Phys. Chem. Russ., 1937, **10**, 418—427).—The viscosity of cellulose acetate (I) solution is the lower the smaller is the ash content. CaO causes gelation of (I) solutions, followed, after a time, by syneresis. Assuming that the min. amount of CaO sufficient to cause gelatinisation corresponds with 1 mol. per principal valency chain it is calc. that the min. mol. wt. of (I) is 15,000, a val. of the same order of magnitude as those obtained by other methods. The CaO probably reacts with the terminal groups of the chains. R. C.

Mechanism of deformation and fine structure of hydrous cellulose. III. Mechanism of deformation and swelling anisotropy in hydrous cellulose gels of different degrees of swelling. P. H. HERMANS and A. J. DE LEEUW (Kolloid-Z., 1938, **82**, 58—67; cf. A., 1938, I, 79).—Measurements of anisotropy produced in the extension of partly swollen isotropic gels show that little orientation of the fibrous network occurs when the cellulose is air-dry or only slightly swollen. Fully swollen gels in which H_2O has been replaced successively by EtOH, xylene, and Et_2O become white and opaque on exposure to air, but still retain 60% of their wt. of Et_2O after heating 3 hr. at 105°. Extension of aëro- and organogels is accompanied by an orientation of the fibrous network less complete than in the hydrogels, whereas with air-dried gels rupture of the internal structure and the development of air spaces occur. F. L. U.

Silicic acid gels. VIII. Time of set of gels containing strong acids. C. B. HURD, K. J. FREDERICK, and C. R. HAYNES (J. Physical Chem., 1938, **42**, 85—93; cf. A., 1937, I, 461).—A linear relation exists between log (time of set) and p_H, and between log (time of set) and 1/abs. temp., for silicic acid in presence of HCl, HNO_3, or H_2SO_4 over the range p_H 3—5. The results are discussed with reference to the mechanism of setting. F. L. U.

Studies of dilute solutions of gelatin by X-rays. I. F. HIRATA (J. Chem. Soc. Japan, 1936, **57**, 43—52).—The diameter of the pattern obtained with 2—4·5% aq. gelatin changes with p_H and is a max. at the isoelectric point. CH. ABS. (e)

Properties and structure of organic thixotropic gels. B. KANDELAKI, G. KIKODZE, and N. DOLIDZE (J. Phys. Chem. Russ., 1937, **10**, 524—533).—For the thixotropic gelation of agar and gelatin sols there is an optimum temp., which rises with increasing concn. The viscosity–temp. curves, measured with rising temp., have a max. at this point. Gelation is not solely due to solvation, for if sols capable of gelation are stirred during cooling gelation may be absent, or a solid, non-elastic, loose mass ("false gel") may be formed. The gelatinous character of the latter is due solely to increase in the vol. concn. by increased solvation on cooling. The elasticity of a true gel is due to its organised structure, and the formation of such a gel may be either impeded or promoted by solvation. Any system capable of forming a true gel with H_2O may exhibit thixotropy under favourable conditions of temp. and concn. Ultramicroscopic study has confirmed the results of viscosimetric measurements, and shown that agar and gelatin form gels by the linking up of granules, which probably have a honeycomb structure. R. C.

Protein structure and water absorption. D. J. LLOYD (J. Physical Chem., 1938, **42**, 1—10).—The swelling of gelatin and tissue-proteins is compared and discussed. F. L. U.

Fugacities in gas mixtures. I. R. KRICHEVSKY (J. Amer. Chem. Soc., 1937, **59**, 2733—2737).—An equation embodying Bartlett's rule (A., 1928, 698) is deduced and used to calculate activities of the components in C_2H_4–A and H_2–N_2 mixtures at pressures up to 125 and 1000 atm., respectively. On the assumption that the activity calc. by Bartlett's rule is the geometric mean of the true val. and that calc. by the Lewis–Randall rule, the computed vals. for the above mixtures are within 2—5% of the true vals. F. L. U.

Thermodynamics of solid bodies. A. ÖLANDER (Svensk Kem. Tidskr., 1937, **49**, 304—316).—Applications of thermodynamic principles to alloys are described. The phase relations of the alloys Cd–Au and Cd–Cu have been deduced from entropy data. M. H. M. A.

Dissociation constants of heavy water and of electrolytes dissolved in it. G. SCHWARZENBACH (Z. Electrochem., 1938, **44**, 46—53).—The dissociation consts. of various acids and bases in D_2O are compared with those in H_2O. The relative effects of D-substitution and of solvent influence are discussed. J. W. S.

Dissociation constant of mandelic acid in water. W. H. BANKS and C. W. DAVIES (J.C.S., 1938, 73—78).—Conductivity data for aq. solutions of Na mandelate (I) and *r*- and *l*-mandelic acid at 24·915° yield a val. $3{\cdot}88 \times 10^{-4}$ for the true dissociation const. (K) of the acid. (I) is a normal, completely dissociated salt. Solutions of the Ba salt have low conductivities and it is suggested that these contain appreciable concns. of $OH{\cdot}CHPh{\cdot}CO_2Ba^+$ ion, for which it is deduced that $K = 0{\cdot}17$. The adsorption of the acid on paraffin wax has been studied by conductometric measurements. The area occupied by 1 mol. of acid in the complete unimol. layer is $5{\cdot}9 \times 10^{-16}n$ sq. cm., where n is the ratio of the true area of the surface to the measured area. J. W. S.

Dissociation of benzoic acid in ethyl alcohol. H. VARSILA (Z. physikal. Chem., 1937, **181**, 221—

229).—The dissociation const. of BzOH has been determined in EtOH (99·67%) with varying [NaCl] by measurement of its buffering action, and the thermodynamic dissociation const. and mean ionic diameter are calc. The variation of the activity coeffs. with concn. cannot be explained on the ordinary Debye–Hückel theory. The thermodynamic dissociation const., derived from data for BzOH in EtOH without addition of NaCl, is in accord with the val. obtained for solutions containing NaCl. J. W. S.

Solutions of cellulose.—See A., II, 45.

Individual activity coefficients of ions. S. KANEKO (J. Chem. Soc. Japan, 1936, **57**, 10—11) CH. ABS. (*c*)

Activity coefficients of potassium chloride and of calcium chloride. E. A. GUGGENHEIM and L. A. WISEMAN (Phil. Mag., 1938, [vii], **25**, 45—48).—The formulæ previously derived (cf. A., 1935, 446; 1936, 1204) for the activity coeff. of an electrolyte are applicable to the activity data of Shedlovsky and MacInnes for KCl and $CaCl_2$ (cf. A., 1937, I, 242). C. R. H.

Solubility and dissociation of quinhydrone. A. BERTHOUD and (MLLE.) S. KUNZ (Helv. Chim. Acta, 1938, **21**, 17—22).—The solubility has been determined at 15°, 25°, and 35°, alone, in presence of 0·002N-HCl, and in various quinol solutions. The vals. of the dissociation const. for the change into quinol and quinone are 0·223, 0·259, and 0·291, respectively, and the heat of dissociation is 2350 g.-cal. per g.-mol. J. W. S.

Determination of dissociation constants, solubilities, and distribution coefficients of pantocaine and novocaine bases. J. EISENBRAND and H. PICHER (Arch. Pharm., 1938, **276**, 1—17).—The first and second dissociation consts. have been calc. from data obtained by the use of a glass electrode and from changes in the ultra-violet absorption. The calc. solubilities in H_2O and distribution coeffs. between Et_2O and H_2O at varying p_H agree well with the results of direct measurements. R. S. C.

Exchange between light and heavy oxygen. I. Oxygen interchange between sulphate ions and water. S. C. DATTA, J. N. E. DAY, and C. K. INGOLD (J.C.S., 1937, 1968—1971).—By heating H_2O containing > the normal content of $H_2{}^{18}O$ (*d* 8S p.p.m. > for ordinary H_2O) with ordinary anhyd. Na_2SO_4 or Na_2SO_4 containing excess of ^{18}O with ordinary H_2O it has been shown that H_2O and SO_4'' ions interchange their O atoms, the reaction being catalysed by OH′. It is suggested that the exchange depends on the partial or complete temporary inclusion of a pair of electrons belonging to a foreign O atom in the central valency shell of the SO_4'' ion. This view is in accord with the fact that the highly nucleophilic OH′ ion is a much more effective reagent for the exchange than the feebly nucleophilic H_2O mol. J. W. S.

Equilibria in cadmium iodide solutions. R. G. BATES and W. C. VOSBURGH (J. Amer. Chem. Soc., 1938, **60**, 137—141).—E.m.f. data for the cell $Cd(Hg)|CdI_2(m)|CdI_2(m),Hg_2I_2|Hg$, with 0·01—0·02M-$CdI_2$ and with additions of varying amounts of $CdSO_4$ or KI to the electrolyte, have been determined at 30°. The results are explained by assuming that the solutions contain non-ionised CdI_2, CdI^+, and a complex anion (CdI_3' or CdI_4''); the corresponding equilibrium consts. have been calc. E. S. H.

Spontaneous emulsification and reactions overshooting equilibrium. J. W. MCBAIN and TS-MING WOO (Proc. Roy. Soc., 1937, **A**, **163**, 182—188).—A study of spontaneous emulsification in the absence of mechanical stirring leads to the conclusion that the effect is due partly to local movements resulting from lowered surface tension. An important factor is the collision of mols. in diffusing columns which carry other mols. with them. G. D. P.

System magnesium oxide–water. R. JAGITSCH (Z. physikal. Chem., 1937, **181**, 215—220).—The hydration of MgO has been studied gravimetrically and by Hahn's emanation method. In moist air (partial pressure of H_2O 16 mm.) the process occurs in two stages; a rapid surface absorption occurs until about 1·4% of H_2O has been absorbed and this is followed by a slower process, which for MgO prepared by heating $Mg(OH)_2$ at 640° is half complete in 430 min. and finally yields a product of the composition $MgO,1{\cdot}5H_2O$. Both processes follow laws of the form $dc/dt = k(c_\infty - c_t)$, where $c = [H_2O]$ in the solid. The velocities of both processes and the total amount of H_2O absorbed decrease with rise of temp. of ignition of the MgO. From the amount of H_2O absorbed in the first stage, and neglecting capillary condensation, the surface of MgO ignited at 640° is calc. to be $4{\cdot}5 \times 10^5$ sq. cm. per g. J. W. S.

Dissociation pressures of deuterates of cupric sulphate and of strontium chloride. F. T. MILES and A. W. C. MENZIES (J. Amer. Chem. Soc., 1938, **60**, 87—90).—Data for the systems $CuSO_4,5D_2O \rightleftharpoons CuSO_4,3D_2O$ and $SrCl_2,6D_2O \rightleftharpoons SrCl_2,2D_2O$ at 25—60° are recorded and compared with dissociation pressures for the corresponding hydrates. The related heat vals. are calc. E. S. H.

M.-p. diagram of system sodium pyrophosphate–sodium chloride. S. I. SKLJARENKO and I. E. KRAUZE (J. Phys. Chem. Russ., 1937, **10**, 449—451).—A diagram differing appreciably from Le Chatelier's (A., 1894, ii, 272) has been obtained. The eutectic temp. is 724°. R. C.

Boundary of the softening interval of the binary system $Na_2B_4O_7$–B_2O_3. A. A. LEONTEVA (J. Phys. Chem. Russ., 1937, **10**, 279—282).—The max. temp. (487°) corresponds with $Na_2O,3B_2O_3$. Another max. (425°) occurs at 18 mol.-% $Na_2B_4O_7$. The temp. given for $Na_2B_4O_7$ and for B_2O_3 are 438° and 250°, respectively. J. J. B.

Physicochemical study of the system $LiNO_3$–NH_3. M. A. PORTNOV and N. K. DVILEVITSCH (J. Gen. Chem. Russ., 1937, **7**, 2149—2153).—The fusion diagram for the system $LiNO_3$–NH_3 suggests the formation of $LiNO_3,2NH_3$, m.p. 14·5°, $LiNO_3,4NH_3$, m.p. 5·8°, and $LiNO_3,8NH_3$, m.p. −62°. The *d*– and conductivity–composition curves are given. The decomp. potential of $LiNO_3$ falls from 5·2 v. at −40° to 4·0 v. at 25°. R. T.

System K_2SiO_3–SiO_2. F. C. KRACEK, N. L. BOWEN, and G. W. MOREY (J. Physical Chem., 1937, **41**, 1183—1193).—Equilibrium data relating to the liquidus have been redetermined (cf. A., 1930, 162). Reversible inversions occur at 592°±2° near $K_2Si_4O_9$ and at 594±2° near $K_2Si_2O_5$. The latent heat of the latter inversion is 1·2±0·5 g.-cal. per g. Preps. in the disilicate region are extremely hygroscopic at temp. up to 500°. Omission of stringent precautions to prevent access of H_2O vapour lead (as in the previous work) to discrepancy between the analytic and synthetic compositions, and to incorrect liquidus temp. resulting from the formation of large crystals and consequent lack of homogeneity. F. L. U.

Thiosilicates. II. Thiosilicates of lead, silver, and thallium. G. G. MONSELISE (Gazzetta, 1937, **67**, 748—750; cf. A., 1937, I, 92).—A thermal study of the systems PbS–SiS_2 and Ag_2S–SiS_2 confirms the existence of the compounds $3PbS,2SiS_2$, $4Ag_2S,SiS_2$, and $3Ag_2S,2SiS_2$. O. J. W.

Equilibrium diagram of the system $CaO,Al_2O_3,2SiO_2$–CaO,TiO_2. U. NISHIOKA (Kinz.-no-Kenk., 1935, **12**, 537—542).—The diagram is of the simple eutectic type (eutectic point 1350°, CaO,TiO_2 35%). The system $2CaO,Al_2O_3,SiO_2$–CaO,TiO_2,SiO_2 is not a stable pseudo-binary system. CH. ABS. (e)

System sulphuric acid–ethers. I. System sulphuric acid–methyl ether. S. K. K. JATKAR and N. G. GAJENDRAGAD (J. Indian Inst. Sci., 1937, **20**, A, 87—93).—The viscosity at 25° shows no max. at H_2SO_4,Me_2O. Conductivity data for mixtures of H_2SO_4 with Me_2O and Et_2O suggest that the conductivity is attributable to H_2O formed as a result of sulphonation. D. F. R.

Equilibrium in the system benzoic and hippuric acids, glycine, and water. C. L. INGERSOLL and G. H. BURROWS (J. Amer. Chem. Soc., 1938, **60**, 136—137).—Data are recorded for 136°, 184°, and 194°. The calc. heat of hydrolysis of hippuric acid is −7850 g.-cal. E. S. H.

Freezing of solutions as a method of studying some problems of pure chemistry. XI. Crystal–liquid equilibria in mixtures containing the antipodes of α-bromopropionic acid and of alanine. J. TIMMERMANS and J. JAFFÉ (Bull. Soc. chim. Belg., 1937, **46**, 471—502).—The f.-p. curves for systems containing one of the optically-active forms of $CHMeBr{\cdot}CO_2H$ (I) and of $NH_2{\cdot}CHMe{\cdot}CO_2H$ (II) together with another optically-active substance have been studied. As a rule replacement of one of the constituents by its optical enantiomeride does not change the form of the curve, but differences are found in the following cases: *l*-malic acid and *l*-asparagine both yield eutectics with the *d*-form of (I) but show compound formation with the *l*-form; the *l*-form of (I) gives a compound with *l*-chloromalic acid but a eutectic is formed with *d*-chloromalic acid; *d*-phenylglycollic acid forms a eutectic with the *d*-form of (II) but a compound is obtained with the *l*-form. On the assumption that the formation of a eutectic implies a greater similarity of configuration than does the formation of a compound, the authors arrive at conclusions which agree in general with those of Freudenberg (A., 1928, 153, 735), although opposite configurations are assigned to (I) and to malic acid. F. J. G.

Equilibria in the ternary system $MgSO_4$–EtOH–H_2O. D. N. TARASENKOV and K. KATZ (J. Gen. Chem. Russ., 1937, **7**, 2243—2245).—The solubility of $MgSO_4$ has been determined in 0—71·6% aq. EtOH, at 25° and 50°. The solid phase in equilibrium with the saturated solutions is $MgSO_4,7H_2O$ at 25°, and $MgSO_4,6H_2O$ at 50°. Stratification of the systems takes place within the range 4·1—60·38% EtOH at 50°. R. T.

Equilibria in the ternary systems: hexane–alcohol–water, and *cyclo*hexane–alcohol–water. D. N. TARASENKOV and I. A. PAULSON (J. Gen. Chem. Russ., 1937, **7**, 2143—2148).—*cyclo*Hexane is miscible in all proportions with 94·4—100% EtOH at 0°, and with 91·8—100% EtOH at 25°; the corresponding vals. for *n*-hexane are 97·3—100% EtOH at 0° and 96·6—100% EtOH at 25°. The phase diagrams of the systems are given for 0° and 25°. R. T.

Solid–liquid equilibria in systems of organic components. VII. Ternary systems with limited miscibility in the molten state. K. HRYNAKOWSKI and M. SZMYT (Z. physikal. Chem., 1937, **181**, 113—123; cf. A., 1937, 1, 308).—The m.p. surfaces of the systems sulphonal–$CO(NH_2)_2$–antipyrine and sulphonal–$CO(NH_2)_2$–salipyrine have been determined. The miscibility-gap in the system sulphonal–$CO(NH_2)_2$ is attributable to the association of $CO(NH_2)_2$. R. C.

Reciprocal salt systems. V. A. PLOTNIKOV and U. I. SCHVARTZMAN (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 137—153).—The system $AlCl_3$–$SbBr_3$ is of the simple type with a eutectic at 8·39 mol.-% $AlCl_3$ and 86°; on the other hand the system $AlBr_3$–$SbCl_3$ affords evidence that this is transformed into the reciprocal system. The reciprocal pairs $AlBr_3$–KCl and $AlCl_3$–KBr exhibit no sign of interchange, but the compounds $2AlBr_3,KCl$, m.p. 83·5°, $AlBr_3,KCl$, m.p. 171°, and $AlCl_3,KBr$, m.p. 213°, are formed. K. S.

Equilibrium diagram of the system iron–iron sulphide–manganese sulphide–manganese. R. VOGEL and W. HOTOP (Arch. Eisenhüttenw., 1937—1938, **11**, 41—54).—In the Mn–MnS system the miscibility gap extends from 0·3 to 33·5% S at 1580°; MnS melts at 1600°±10° and forms a eutectic with Mn at 1230° containing very little MnS. The liquidus of the Fe–FeS–MnS–Mn section of the Fe–Mn–S system established by earlier workers has been confirmed. The crystallisation conditions are determined by two maximal lines of three-phase equilibrium, one at 1600° between liquid sulphide, Fe–Mn solid solution, and a sulphide–metal solid solution, and one at 1570° between a eutectic liquid, MnS–FeS solid solution, and Fe–Mn solid solution. At 1000° there is a eutectic 4-phase plane the ternary eutectic point of which is practically identical with the binary eutectic point of the Fe–FeS system. Space models of the whole system and sections through various parts are reproduced, together with characteristic micrographs of the structure. A. R. P.

Chemistry of sulphur dioxide reduction. Thermodynamics. R. LEPSOE (Ind. Eng. Chem., 1938, **30**, 92—100).—The v.p. of various forms of gaseous S in equilibrium with molten and solid S, and the equilibria corresponding with the reduction of SO_2 by CS_2, H_2S, C, CO, H_2, and CH_4, are calc. from thermodynamical data. I. C. R.

Thermodynamic data for gaseous sulphur compounds. A. V. AVDEEVA (J. Chem. Ind. Russ., 1937, **14**, 1688—1693).—Free energy, entropy, and sp. heat data are recorded for SO_2, CS_2, COS, and H_2S. The heats of formation of these substances, and of S from S_2, are determined by a spectrographic method; this is more particularly to be preferred to the calorimetric method in the case of the formation of CS_2 from graphite and gaseous S_2. R. T.

Thermodynamic data for manganous sulphide and standard electrode potential of manganese. K. SANO (Kinz.-no-Kenk., 1935, **12**, 548—550).—The recorded data are: $\Delta H_0 = -46200 + 4{\cdot}496T - 0{\cdot}0058T^2$, $\Delta F^\circ = -41200 - 4{\cdot}496 \log T + 0{\cdot}0058T^2 + 30{\cdot}38T$; E°_{298} (Mn|Mn^{++}) = +1·029 v. CH. ABS. (*e*)

Thermochemistry of complex aluminium compounds. V. A. PLOTNIKOV and S. I. JAKUBSON (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 115—120).—The heat of formation of complexes of $AlCl_3$ with LiCl, NaCl, KCl, NaBr, and KBr and of $AlBr_3$ with NaCl and KCl (of the type $AlCl_3$,LiCl) has been measured. The heat of formation increases from Li to K with both $AlCl_3$ and $AlBr_3$ and from Cl to Br for a given alkali halide. K. S.

Heat of neutralisation of nitrous acid and thermochemistry of its salts. M. DODÉ (Bull. Soc. chim., 1937, [v], **4**, 2093—2105).—The heat of neutralisation of HNO_2 by NaOH is 10·44 kg.-cal. Recorded heats of formation (from the elements) are: $LiNO_2$ 91·3, $NaNO_2$ 88·25, KNO_2 90·7, $Ca(NO_2)_2$ 181·6, $Sr(NO_2)_2$ 186·0, $Ba(NO_2)_2$ 187·7 kg.-cal. E. S. H.

Heat of the reaction between calcium hydroxide and kaolin, aluminium hydroxide, and silicic acid after their ignition at various temperatures. P. P. BUDNIKOV and L. G. GULINOVA (Kolloid. Shurn., 1937, **3**, 195—207).—The heat of reaction of saturated aq. $Ca(OH)_2$ with $Al(OH)_3$ is max. when the latter has not been ignited; with SiO_2 a max. is found after heating at 600° for 1 hr., and with kaolin after heating at 700—800° for 1 hr. When the substances have been heated at >1100° the heat of reaction is zero. The electrical conductivity of the mixtures decreases with time, the rate of decrease being the greater the higher is the heat of reaction. J. J. B.

Thermal properties and solvent power of heavy water. E. LANGE (Z. Elektrochem., 1938, **44**, 31—43).—Thermal data for D_2O, HOD, and H_2O alone and in equilibrium with one another are summarised and compared. The differences of thermal behaviour between H_2O and D_2O in salt hydrates and in systems which contain H_2O (D_2O) together with dioxan, $Hg(CN)_2$, Et_2O, PhOH, C_5H_5N, or nicotine are discussed. The solubilities and heats of dissolution of various salts in H_2O and D_2O are also compared. J. W. S.

Conductance of non-aqueous solutions. III. Organosodium compounds in ether. N. B. KEEVIL and H. E. BENT (J. Amer. Chem. Soc., 1938, **60**, 193—196; cf. A., 1936, 565).—Data for the Na salts of diphenyl-α-naphthylmethyl, fluorenone, phenyldiphenylyl-α-naphthylmethyl, phenylfluoryl, and $(:CPh_2)_2$ at 25° are recorded. The results are discussed with reference to the structure of the ions and the rôle of the solvent. E. S. H.

Determination of hydration of the SO_4'' anion from the electrolytic transport of water. J. BABOROVSKÝ and G. KOUDELA (Chem. Listy, 1938, **32**, 5—9).—A method is described which leads to the val. 1·4 mols. H_2O per SO_4''. R. T.

Potential of the silver-silver ferrocyanide electrode at 25°. J. N. PEARCE and L. D. OUGH (J. Amer. Chem. Soc., 1938, **60**, 80—82).—The potential of the electrode Ag,$Ag_4Fe(CN)_6$,$Fe(CN)_6''''$ (a = 1), derived from e.m.f. measurements of the cell Ag|$Ag_4Fe(CN)_6$,$K_4Fe(CN)_6$ (0·1 *m*)|(0·05 *m*) $K_4Fe(CN)_6$,$Ag_4Fe(CN)_6$|Ag, is 0·1943 v. The calc. vals. of the activity product const. and the mol. solubility in H_2O of $Ag_4Fe(CN)_6$ are $1{\cdot}546 \times 10^{-41}$ and $2{\cdot}27 \times 10^{-9}$, respectively. E. S. H.

Potential of silver and some other metals in solutions of halides. I. P. MORKOVKO and E. V. ZMATSCHINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 211—213).—The potentials of a Ag electrode in 0·001—4N aq. NaCl, NH_4Cl, $BaCl_2$, $CdCl_2$, and KI, and of Ag, Cu, Pt, Au, and Ni electrodes in aq. KCl have been measured at 18—50°. The vals. can be expressed by $E = a + b \log \alpha$ (α = activity of the halide solution). a and b are consts. with different vals. for conc. and dil. solutions, transition occurring at about 0·5—N. For dil. solutions the val. of a is characteristic of the electrode and anion, but independent of the nature of the cation, but b is identical for Cu and Ag electrodes and approximates to RT/nF. J. W. S.

Origin of the potential difference at some metals in foreign ion solutions. I. P. MORKOVKO and E. V. ZMATSCHINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 213—216; cf. preceding abstract).—The electrode potentials of Ag and Cu electrodes in halide solutions are attributed to reaction of the metal with the halide ion, yielding the insol. metal halide. The vals. for Ag in dil. aq. NaCl and KI are in accord with the potentials of the Ag|AgCl|Cl′ and Ag|AgI|I′ electrodes, respectively. The potentials of electrodes of the type Ag|$CuSO_4$ are attributed to dissolution of the electrode metal and deposition of the cation metal, yielding secondary electrodes of the type Ag,Cu|Ag$^+$,Cu^{++}. For this electrode the observed potentials differ by a small but const. amount from the mean of the vals. for the Ag|Ag$^+$ and Cu|Cu^{++} electrodes at the same concns. J. W. S.

Hydrogen-chlorine electrode: an example of a periodic reaction. K. BIASTOCH (Z. physikal. Chem., 1937, **181**, 133—150; cf. A., 1933, 572).—The potential, e, of a Pt electrode in aq. HCl through

which a mixture of H_2 and Cl_2 is passing has been measured. If the H_2 pressure is $<0{\cdot}98$ atm. (for a total pressure of 1 atm.) the electrode behaves as a Cl electrode, whilst for higher H_2 pressures it behaves as a H_2 electrode. At very small Cl pressures e oscillates periodically for some time between a max. and min. val., ultimately rising to the Cl potential and remaining const. The time required to reach this steady potential with a platinised electrode is $\gg$ with a bright electrode. With rise of temp. the period of oscillation falls. The effects of stirring and illumination have been examined. R. C.

Theory of glass electrode. I. B. P. NIKOLSKI. **II. Effect of boric and aluminium oxides on electrode properties of glass. III. Transition from hydrogen to sodium electrode function.** B. P. NIKOLSKI and T. A. TOLMACHEVA (J. Phys. Chem. Russ., 1937, **10**, 495—503, 504—512, 513—523).—I. Starting from the theory that the action of the glass electrode depends on exchange of $H^{\cdot}$ for $Na^{\cdot}$ ions between the solution and a layer, several mols. thick, on the surface of the glass, which then behaves as a solid electrolyte, it is deduced thermodynamically that the electrode potential is given by $E = E_0 + (RT/F)\log(a_{H^{\cdot}} + Ka_{Na^{\cdot}})$, where $a_{H^{\cdot}}$ and $a_{Na^{\cdot}}$ are the activities of the $H^{\cdot}$ and $Na^{\cdot}$ ions in the solution, and K (the equilibrium const. for the exchange) is given by $K = a_{H^{\cdot}}a'_{Na^{\cdot}}/a'_{H^{\cdot}}a_{Na^{\cdot}}$, where $a'_{H^{\cdot}}$ and $a'_{Na^{\cdot}}$ are activities in the equilibrium layer of the glass.

II. Electrodes of glasses of various compositions were immersed in H_2O and E was measured during progressive addition of NaOH to the H_2O. With increasing p_H the numerical val. of E first increases linearly, the electrode behaving as a H electrode, but at higher p_H the E–p_H curve ceases to be linear and passes through a max., the electrode ultimately behaving as a Na electrode. The presence of B_2O_3, and still more of Al_2O_3, lowers the p_H at which the relation between p_H and E ceases to be linear. This effect appears to be due to these oxides causing the glass to hold $Na^{\cdot}$ ions more firmly and $H^{\cdot}$ ions less firmly. The E–p_H curves for aq. LiOH are similar to those for aq. NaOH; $Li^{\cdot}$ ions can penetrate into glass as easily as $Na^{\cdot}$ ions. $Ba^{\cdot\cdot}$ ions have little effect on E. The effect of $K^{\cdot}$ ions is small unless the glass contains Al_2O_3 or B_2O_3.

III. The validity of the above equation for E has been confirmed by determinations of E in solutions in which $[Na^{\cdot}]$ is const. and $[H^{\cdot}]$ varied, and in which $[H^{\cdot}]$ is const. and $[Na^{\cdot}]$ varied. Three methods of calculating K from the experimental data have been deduced, and give concordant results. There is evidence that some $H^{\cdot}$ ions are held by glass less firmly than the rest. The results are incompatible with Gross and Halpern's theory of the glass electrode (cf. A., 1934, 601). R. C.

[Cell] combination of platinum with the metals in solutions of their salts. (MLLE.) S. VEIL (Compt. rend., 1937, **205**, 1371—1373).—The variation of E with c in the cell $Cu|CuCl_2(c)|Pt$ has been investigated. The replacement of $CuCl_2$ by $Cu(NO_3)_2$ or $CuSO_4$ has also been examined. A. J. E. W.

Electromotive force of non-isothermal hydrochloric acid cells. Z. SZABÓ (Z. physikal. Chem., 1937, **181**, 169—182).—The e.m.f. of cells of the type $Ag|AgCl|HCl\ (m,\ T_1)|HCl\ (m,\ T_2)|AgCl|Ag$ has been measured for a series of vals. of m and T_2—T_1. The results indicate that for m $<0{\cdot}2$M the ionic activities in HCl are equal. The ionic activities at higher concns. are estimated. J. W. S.

Dependence of the height of the polarographic wave on the concentration of the ion being deposited and of accompanying ions. P. N. PAVLOV (J. Gen. Chem. Russ., 1937, **7**, 2246—2258).—The height of the polarographic wave obtained with $FeSO_4$ and $Cd(OAc)_2$, but not with $ZnCl_2$, $SnCl_2$, or $NiCl_2$ solutions, $\propto$ the respective concns. The height of the wave falls to a min. and then rises as the concn. of accompanying electrolytes is raised. The max. depressing effect for different ions is given by the series $Al > Ca > Na$, and $SO_4 > OAc > Cl > NO_3$. R. T.

Theory of limiting currents. III. General solutions with excess of one indifferent electrolyte. D. MACGILLAVRY (Rec. trav. chim., 1938, **57**, 33—40; cf. A., 1937, I, 620; 1938, I, 34).—A mathematical treatment of solutions containing any no. of ionic species together with an excess of an indifferent electrolyte. The general theory of limiting currents is given and a formula derived for the complete polarographic wave in the case of growing and of steady Hg drops. K. W. P.

Properties of metallic ions in [ethyl] alcohol. P. BRUN (Compt. rend., 1937, **205**, 1385—1386).—The decomp. potentials of solutions of NaOEt and KOEt in EtOH are 1·6 and 1·5 v., respectively; these vals. are slightly lower than those obtained for aq. NaOH and KOH (1·7 v.). The ionic mobilities are $U_{Na^{\cdot}} = 0{\cdot}35$, $U_{K^{\cdot}} = 0{\cdot}44$, which are slightly lower than the vals. in aq. solution. EtOH solutions of the ethoxides thus resemble aq. solutions of the hydroxides. A. J. E. W.

Devaux' reaction (copper–copper sulphide) in a limited surface. J. CAYREL (Compt. rend., 1938, **206**, 53—55; cf. A., 1936, 566, 687).—Examination of the cell $Cu|CuS|CuSO_4|Cu$ has shown that polarisation occurs when the Cu–CuS layer completely covers the solution surface. This polarisation is due to the deposition of a second Cu layer on the CuS particles; the Cu in this layer probably exists in a different state. The original layer is six mols., and the second three mols., thick. A. J. E. W.

Effect of alloy formation on the decomposition voltage of a copper electrode. V. A. PLOTNIKOV and D. P. ZOSIMOVITSCH (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 125—135).—In the case of a short-circuit between the electrodes of a cell consisting of two metals in a salt solution containing the metal with the more negative potential, the decomp. voltage of the more positive electrode falls until it becomes equal to that of the other electrode and the effective cell voltage zero. The effect is shown to be due to the formation of an alloy on the more positive electrode. K. S.

Relation of cathodic current density to structure of electro-deposited metal. A. T. VAGRAMIAN (J. Phys. Chem. Russ., 1937, **10**, 443—448; cf. A., 1937, I, 625).—In the growth of a metal crystal by electro-deposition in a given electrolyte solution the cathodic c.d., referred to the active surface area of the cathode, does not change with variations in current strength. Constancy of the c.d. when the current strength rises considerably is ensured by the formation of a porous deposit. The growth of the crystal occurs by accretion of layers, the simultaneous deposition of several of which starts at the corners and edges. The more rapidly they spread over the faces the thinner they are. The no. and rate of growth of the layers affect the surface area, and therefore depend on the current strength. The thickness of the layers determines the form of the crystal. R. C.

Co-deposition of metals of unlike valency in acid solutions. W. G. PARKS and I. M. LE BARON (J. Physical Chem., 1938, **42**, 125—131; cf. A., 1936, 1343).—The variation of the limit of co-deposition with c.d. has been determined for Cu–Tl, Pb–Tl, Ag–Cu, and Ni–Tl in solutions of the nitrates at p_H 5 and at room temp. A general empirical equation is derived for uni–bi-valent pairs of metals. F. L. U.

Atomic hydrogen. I. Calorimetry of hydrogen atoms. II. Surface effects in the discharge tube. III. Energy efficiency of atom production in a glow discharge. H. G. POOLE (Proc. Roy. Soc., 1937, **A**, **163**, 404—414, 415—423, 424—454).—I. A continuous-flow calorimeter is described by means of which the amount of H in a stream of partly dissociated H_2 can be determined.

II. The method is applied to determine the output of at. H from different types of discharge tubes. Const. and reproducible output is obtained with tubes lined with HPO_3. In the absence of such a lining the behaviour of glass and SiO_2 tubes depends on their past history.

III. The relation between the nos. of atoms produced per sec. and the electrical energy supplied to the discharge tube has been studied. A theory is developed which gives a satisfactory account of the behaviour of the tube. The velocity coeff. for the wall-catalysed recombination of atoms has been determined and the flow of a mixture of H_2 mols. and H atoms through a tube is discussed. G. D. P.

Passivity of chromium. VI. E. MÜLLER (Z. physikal. Chem., 1937, **181**, 89—112; cf. A., 1937, I, 141).—The behaviour in 2M-H_2SO_4 and -HCl at room temp. of electrolytic Cr (I) and Cr made by the thermit reaction (II) has been examined. (I) becomes immediately electromotively active in HCl because it is "loosened" by the H which is dissolved in it. If first treated with HNO_3 it remains passive for some time in HCl, because H near the surface has been oxidised. In HCl, (II) behaves like (I) which has been treated for a short time with HNO_3. Long treatment of (II) with HNO_3 apparently increases the period of incubation in HCl indefinitely, probably because the "loose places" have been removed. In H_2SO_4, (II) loses its active centres and does not become active, which lengthens the incubation time in HCl. At. H separated electrolytically on (II) does not dissolve in the metal, but is only loosely held. (II) is made active in H_2SO_4 by rubbing under the surface of the acid to form active centres. In both H_2SO_4 and HCl Cr yields the bi- and ter-valent forms simultaneously. It is passive in HNO_3 because $Cr + 2\oplus \rightleftharpoons Cr^{\cdot\cdot}$ occurs only at active centres or loose places. In general, the coating theory of passivity is irreconcilable with the above observations. Cr dissolves in acids when the loose surface atoms are numerous enough to raise the potential to the activation potential by the change $Cr \rightarrow Cr^{\cdot\cdot} + 2\ominus$. R. C.

Electrometric study of dilute aqueous solutions of halogenated ketones. E. G. EDWARDS, D. P. EVANS, and H. B. WATSON (J.C.S., 1937, 1942—1967).—The velocities of appearance of $H^{\cdot}$ and halogen ions in dil. aq. solutions of halogenated ketones have been measured with a glass electrode and Ag|Ag halide electrodes, respectively. It seems that the acidity is due to hydrolysis of the ketone, but that either replacement of the halogen by OH or the production of CHX_3 (X = Cl, Br, I) may be the predominating reaction, or both occur simultaneously. The structural factors facilitating these processes are discussed. J. W. S.

Configuration of carbohydrates from conductivity measurements in boric acid solution.—See A., II, 43.

Oxidation–reduction potentials in organic systems. R. WURMSER (Bull. Soc. chim., 1937, [v], **4**, 1942—1962).—A lecture.

Titration constants of anserine, carnosine, and related compounds. A. DEUTSCH and P. EGGLETON (Biochem. J., 1938, **32**, 209—211).—Titration consts. of methylhistidine, carnosine, and anserine have been determined with a H electrode at 22°. The last two differ very little in their apparent dissociation consts. and both act as buffers over the range p_H 6 to 8. J. N. A.

Theory of reaction velocity. C. N. HINSHELWOOD (Trans. Faraday Soc., 1938, **34**, 105—112).—The present position is reviewed with special reference to activation energies, the non-exponential term of the Arrhenius equation, the influence of and distribution law for collision times, and collision rates in liquid systems. E. S. H.

Theory of absolute reaction rates. H. EYRING (Trans. Faraday Soc., 1938, **34**, 41—48).—Published work on the general statistical mechanical theory of reaction rates is summarised and the application of the theory to numerous examples reviewed. E. S. H.

Calculation of activation energies. H. EYRING (Trans. Faraday Soc., 1938, **34**, 3—11).—Published work is discussed. E. S. H.

Application of equilibrium theory to reaction kinetics. E. A. GUGGENHEIM and J. WEISS (Trans. Faraday Soc., 1938, **34**, 57—70).—Theoretical. The distinction between uni- and bi-mol. mechanisms on the one hand and first and second order reactions on the other is emphasised. Theory is discussed in

relation to published data for the cases of uni- and bi-mol. reactions in the gaseous phase and in solution. E. S. H.

Transition state method. E. WIGNER (Trans. Faraday Soc., 1938, **34**, 29—41).—Theoretical. The transition state method, which is applicable to reactions which involve no jump in the electronic quantum nos. but change the constitution, is shown to be based, in addition to established principles of statistical mechanics, on only three assumptions, two of which are generally accepted. E. S. H.

Thermodynamical treatment of transition state. M. G. EVANS (Trans. Faraday Soc., 1938, **34**, 49—57).—Theoretical. E. S. H.

Parameters of the Arrhenius equation. C. N. HINSHELWOOD (Trans. Faraday Soc., 1938, **34**, 138—141).—Published work is summarised. E. S. H.

Relationships between dipole moments and reaction velocities. H. B. WATSON (Trans. Faraday Soc., 1938, **34**, 165—171).—A crit. discussion of published work. E. S. H.

Linear free energy relationships in rate and equilibrium phenomena. L. P. HAMMETT (Trans. Faraday Soc., 1938, **34**, 156—165).—A crit. review of published work, with special reference to the influence of substituents on the reactions of C_6H_6 derivatives. E. S. H.

Kinetics of proton transfer reactions. R. P. BELL (Trans. Faraday Soc., 1938, **34**, 229—236).—Published work is discussed. E. S. H.

Kinetics of bimolecular associations in the gaseous and condensed phase. A. WASSERMANN (Trans. Faraday Soc., 1938, **34**, 128—137).—Published data for the rate of bimol. processes in two states are compared with measured rates of homogeneous bimol. and reversible associations in the gaseous phase in various solvents and in the pure liquid state. The bimol. collision no. in the condensed state is defined by A_c/P_g, where A_c (condensed) is the non-exponential term of the Arrhenius equation and P_g (gaseous) the steric factor. For three associations a lower limit of the collision no. in various solvents has been estimated and for two other associations its order of magnitude in solution and in the pure liquid state determined. The A val. of one association in paraffin was $>$ in the gaseous phase. Relations between solubility data and kinetic measurements are discussed. The agreement of the activation energies of two gaseous reactions with those of the corresponding reactions in the condensed phase is due to the fact that the energies of condensation of the initial state and of the transition state are approx. equal. The energies of condensation are of the same order of magnitude as the sublimation energies of org. crystals. E. S. H.

Bimolecular association reactions. L. S. KASSEL (J. Chem. Physics, 1937, **5**, 922—924).—Mathematical. An extension of Kimball's classical treatment of the rates of bimol. association reactions (A., 1937, 1, 415) indicates an essentially different dependence of reaction probability on vibrational energy initially present in the natural co-ordinates as kinetic energy from that present as potential energy. In the absence of any quantum-mechanical analogy it is concluded that the classical treatment is unsatisfactory. W. R. A.

Rate of ionisation. I. Ionisation of C–H linkings. C. L. WILSON. **II. Ionisation of C–halogen linkings.** E. D. HUGHES (Trans. Faraday Soc., 1938, **34**, 175—185, 185—202).—I. Published work on relations between tautomeric phenomena and proton transfer is reviewed.

II. A crit. discussion of published work, with particular reference to the mechanism of substitution reactions. E. S. H.

Inertia and driving force of chemical reactions. M. G. EVANS and M. POLANYI (Trans. Faraday Soc., 1938, **34**, 11—24).—In reactions of the type $A + BC = AB + C$, inertia is primarily due to the binding force in BC, and is reduced by the action of the binding force AB if A is brought close to B. The linking strength, which causes inertia for the forward reaction, acts as driving force in the opposite direction. The repulsion between A and BC and that between AB and C cause an increase in the activation energy; this constitutes a second form of inertia, which operates equally in both directions. The inertia which arises from repulsion counteracts the driving force. The nature of repulsion and the special case of the absence of repulsion on one side of the reaction are discussed. E. S. H.

Thermal analysis of chemical reaction velocity. S. HORIBA [with M. TAMURA, W. JONO, H. BABA, Y. NAKANISHI, T. KOSAKI, and E. SUITO] (Rev. Phys. Chem. Japan, 1937, **11**, 189—201).—A summary. The course of a no. of reactions is studied by means of measurements of the heat changes which take place. The chain-breaking reaction in the photochemical combination of H_2 and Cl_2 is probably $Cl_3 + Cl_3 \rightarrow 3Cl_2$. The reduction of CrO_3 with oxalic acid is a first order, and with tartaric acid a second order, reaction. The decomp. of colloidal Pt with H_2O_2 takes place in two stages; in the first the reaction velocity $\propto [H_2O_2][Pt]^2$, whilst the second stage is a first order reaction. The following photochemical reactions are investigated: $CO + Cl_2 = COCl_2$; $2H_2 + O_2 = 2H_2O$; decomp. of H_2O_2; action of invertase. F. J. L.

Theory of steric hindrance. W. HÜOKEL (Z. physikal. Chem., 1937, **181**, 239—242).—Polemical against Brenschede (cf. A., 1938, 1, 36). J. W. S.

[Theory of steric hindrance.] W. BRENSCHEDE (Z. physikal. Chem., 1937, **181**, 243).—A reply to Hückel (cf. preceding abstract). J. W. S.

Kinetics of polymeric aldehydes.—See A., II, 42.

Chemical reactions of deuterium atoms. K. H. GEIB (Z. Elektrochem., 1938, **44**, 81—87).—A summary. The mechanisms of the reactions of D atoms with various gases are discussed. The effect of substitution of D for H in various hydrides on their reaction velocities is discussed. J. W. S.

Comparison of rates of racemisation and hydrogen exchange in a ψ-acidic ketone.—See A., II, 101.

Direct formation of iodides and the distance of closest approach of atoms of iodine. B. N. SEN (Proc. Nat. Acad. Sci. India, 1937, **7**, 6—10).—It is proposed that there is a crit. at. approach val. for atoms below which an atom would take part in a reaction. The crit. val. for the formation of iodides and the distance of closest approach of I atoms are calc. as 1·75 A., in each case. N. M. B.

Rate of isomerisation of an optically active azomethine.—See A., II, 101.

Flame velocities. I. Possibility of calculating flame velocities theoretically. W. JOST and L. VON MÜFFLING (Z. physikal. Chem., 1937, **181**, 208—214).—Theoretical. It is shown that, in general, diffusion processes in the zone of combustion should not be neglected, and that an ignition temp. should not be introduced without reference to the reaction velocity. J. W. S.

Kinetics of the conjugated chain oxidation of sulphur dioxide in solution by ozonised air. S. S. VASSILIEV, L. I. KASCHTANOV, and T. L. KASTORSKAIA (J. Phys. Chem. Russ., 1937, **10**, 330—341; cf. A., 1936, 1075).—Air containing SO_2 and O_3 was bubbled through H_2O. If the no. of SO_2 mols. oxidised by one mol. of O_3 be ν, then $\nu = 1 + k[SO_2]/[O_3]$, k being a const. and the concns. measured in the air. The relation of the SO_2 oxidised by the O_3 to that oxidised by the O_2 of the air increased from approx. 1 to approx. 10 when $[O_3]$ rose from 0·04% to 2·7%. This relation was higher in conc. H_2SO_4 than in H_2O. The possibility of using the oxidation by O_3 to produce SO_3 from technical gases is discussed. J. J. B.

Flame ranges and explosion regions. A. M. VAN DEVENTER (Rec. trav. chim., 1938, **57**, 95—107).—The use of CCl_2F_2 as explosion inhibitor was studied in ternary systems containing air with MeCl, EtCl, and C_4H_{10}, respectively. The system C_4H_{10}–air–EtCl was also examined. Flame range or length of flame in the explosion tube was measured as the test of an explosion. In the first three cases explosion is inhibited by 7, 10, and 13% CCl_2F_2, respectively. The causes of the slow extinction of flame are discussed. K. W. P.

Oxidation of sulphur vapour under low pressure. H. LACHS and W. PIEKIELNY (Bull. Acad. Polonaise, 1937, **A**, 377—398).—The reaction between S vapour and O_2 is initiated by an electric discharge. At a particular temp. there is a min. and max. limiting pressure: 55°, 0·93 and 10 mm. Hg, 95°, 0·17 and 120 mm. The reaction speed is independent of the pressure of O_2 and size of the reaction vessel, and approx. $\propto$ saturation pressure of S vapour (65—95°). The reaction product is SO_2 admixed with some SO_3 (17%), and these slow up the reaction considerably. In the region between min. and max. pressure the reaction chain is probably of infinite length; below the min. pressure the length is finite and the reaction can proceed only by the provision of active centres. The critical temp. is 50°±1°. F. J. L.

Detonation of gas mixtures. III. Effect of lead tetraethyl on setting up of explosion wave. IV. Effect of "chemical preparation" on initiation of detonation in gas mixtures. K. SCHTSCHELKIN and A. SOKOLIK (J. Phys. Chem. Russ., 1937, **10**, 479—483, 484—488).—III. The length of the pre-detonation period, s, of mixtures of C_5H_{12} with O_2 and N_2 at pressures, p, of 100—500 mm. has been determined. In presence of N_2 the p–s curve is stepped, and where s falls rapidly with increasing p addition of $PbEt_4$ lengthens s, whilst where s is changing slowly $PbEt_4$ has little effect. The curve is similar in form to the corresponding curve for the self-inflammation temp. of hydrocarbon–air mixtures. It is inferred that the effect of $PbEt_4$ depends on its action on primary oxidation reactions in the pre-detonation zone behind the flame-front.

IV. The effect on the formation of the detonation wave in a tube of preliminary "chemical prep." of the inflammable mixture by thermal treatment before ignition has been examined. s passes through a min. shortly after the appearance of a cold flame, then rises rapidly, the mixture ultimately failing to detonate. It appears that oxidation processes following the cold flame lead to degradation of the detonative properties of the mixture; premature oxidation may therefore suppress engine-knocking. R. C.

Explosion limits of ethylene oxide, hydrocyanic acid, and carbon disulphide at reduced pressures. G. PETERS and W. GANTER (Angew. Chem., 1938, **51**, 29—33).—Inflammation limits in the systems $(CH_2)_2O$–CO_2–air, HCN–air, and CS_2–CO_2–air at pressures between 60 and 760 mm. are recorded and reviewed in relation to the use of the gases as fumigants. The upper limit in the $(CH_2)_2O$–air system lies at very high $[(CH_2)_2O]$; the limits with $(CH_2)_2O$ and HCN are lowered by reduction of the pressure to an extent necessitating precautions in applying the method of vac. fumigation. J. S. A.

Deuteron transfer in solutions. K. F. BONHOEFFER (Trans. Faraday Soc., 1938, **34**, 252—259).—A crit. discussion of published work. E. S. H.

Collision numbers in solutions. R. H. FOWLER and N. B. SLATER (Trans. Faraday Soc., 1938, **34**, 81—90).—Theoretical. The no. of collisions between solute mols. in a solution which might lead to reaction is calc. on the basis of a model which likens a liquid to a quasi-regular crystal. E. S. H.

Kinetics of ionisation in solution. E. A. MOELWYN-HUGHES (Trans. Faraday Soc., 1938, **34**, 91—104).—Theoretical. A general treatment for the study of the kinetics of reaction in solution is proposed. The frequency of ionic collisions, dissociation into ions, and simple ionisation equilibria in solution are discussed. The velocity of ionic reactions in the gaseous phase is examined in the light of chemical kinetics. E. S. H.

Reaction velocities in heavy water. O. REITZ (Z. Elektrochem., 1938, **44**, 72—80).—Substitution of D_2O for H_2O can affect reaction velocities through pure solvent effects, exchange of D for H in the reactants, or the participation of D_2O and H_2O or their ions in the reaction. Acid- or base-catalysed reactions may therefore proceed more rapidly or more slowly in D_2O than in H_2O. Various examples of

such reactions and also of exchange and enzyme reactions are discussed. J. W. S.

Kinetics of the isotopic exchange of bromine between aluminium bromide and ethyl bromide. N. E. BRESHNEVA, S. Z. ROGINSKI, and A. I. SCHILINSKI (J. Phys. Chem. Russ., 1937, **10**, 367—371).—The rate of the reaction $Al_2Br_5Br^* + EtBr \rightleftharpoons Al_2Br_6 + EtBr^*$ (Br* = radioactive Br) was measured in CS_2 between −23° and 42°. The heat of activation was approx. 11,000 g.-cal. J. J. B.

Interaction of ozone and hydrogen peroxide in aqueous solution. W. C. BRAY (J. Amer. Chem. Soc., 1938, **60**, 82—87).—Analysis of published data (A., 1918, ii, 16) shows agreement with the relation $-d[O_3]/dt \div -d[H_2O_2]/dt = 1 + 5{\cdot}2[O_3]/[H_2O_2]$. The limiting result at relatively low $[O_3]$ is a bimol. reaction with a sp. rate of 50. Two mechanisms of reaction are considered; they involve the intermediate formation of H_2O_3 or of $HO + HO_2$. The energy changes involved are estimated. E. S. H.

Rate of adjustment of calcium hydrogen carbonate solutions. A. VAN HOOK (J. Geol., 1937, **45**, 784—789).—Loss of H_2O by evaporation has no significant effect on the rate of adjustment of $Ca(HCO_3)_2$ solutions. The catalytic effect of $CaCO_3$ is not sp., but is only a general physical effect of an added surface assisting the formation of cryst. $CaCO_3$ and the escape of CO_2. L. S. T.

Depolymerisation process in formaldehyde solutions. A. SKRABAL (Österr. Chem.-Ztg., 1938, **41**, 32—38).—The kinetics of the depolymerisation of aq. polyoxymethylenes (A., 1937, I, 366) are best interpreted by regarding the process as occurring exclusively by scission at the end of the mol., resulting in the shortening of the chain by one monomeric mol. at a time. The hydrolysis is of the same type as that observed with semi-acetals. It is almost complete in dil. solution, and gives rise to equilibrium mixtures in conc. solution. F. L. U.

Velocity of reaction of aldehydes with ketones. VI. Determination of the relative activities of vanillin and salicylaldehyde in their reaction with acetone. E. K. NIKITIN (J. Gen. Chem. Russ., 1937, **7**, 2264—2274).—Vanillin reacts with $COMe_2$ 5·27 times as fast as does salicylaldehyde. Methods of determining the velocity coeffs. of reactions of this type are described. R. T.

Kinetics of thermal polymerisation of dissolved styrene. II. H. SUESS and A. SPRINGER (Z. physikal. Chem., 1937, **181**, 81—88).—The investigation previously described (A., 1937, I, 523) has been extended to solutions in other solvents. With some solvents the mean degree of polymerisation $\propto$ the concn. (c) and with others approx. $\propto \sqrt{c}$. The activity of the solvent in catalysing the initiatory and stabilising reactions increases in the order $C_6H_6 <$ PhMe $< C_7H_{16} <$ PhEt $< C_6H_4Et_2 <$ styrene $< C_2H_4Cl_2 < C_2H_2Cl_4 < CCl_4$. R. C.

Influence of hydrostatic pressure on reaction velocity. M. W. PERRIN (Trans. Faraday Soc., 1938, **34**, 144—153).—The velocities of several org. reactions in EtOH, H_2O, PhMe, $COMe_2$, or $CHCl_3$ have been measured over pressure ranges between 1000 and 12,000 kg. per sq. cm. at different temp. The consts. A and E of the Arrhenius equation for reaction velocity have been calc. from the data, and the variation of k, A, and E with pressure has been studied. The influence of pressure varies with the type of reaction; it is most pronounced in reactions which involve large and complex org. mols. and occur (at 1 atm.) at a much slower rate than would be expected from simple considerations of collision frequency and energy relations. E. S. H.

Reaction kinetics in films. Hydrolysis of long-chain esters. A. E. ALEXANDER and E. K. RIDEAL (Proc. Roy. Soc., 1937, **A**, **163**, 70—89).—The reaction is studied by measurement of surface pressures and potentials of monolayers on alkaline and acid substrates. The velocity coeffs. are evaluated. The reaction velocity is sensitive to changes of mol. orientation and to the products of reaction if these remain in the film. The activation energy and velocity in the expanded state approximate to those in homogeneous solution, and on compression to the condensed state the activation energy rises although the velocity changes only slightly. The reason for the small vals. of the steric factor in the expanded state is discussed. The materials investigated include trilaurin (m.p. 46·0°), tripalmitin (m.p. 64·2°), αα′-dipalmitin (m.p. 71·0°), α-monopalmitin (m.p. 75·5°), and Et palmitate (m.p. 25·0°). G. D. P.

Significance of the interface as reaction partner. F. PAVELKA (Mikrochem., 1937, **23**, 202—216).—The course or rate of reactions may be modified by the action of interfaces due to (*a*) adsorption and removal of a negative catalyst from solution; (*b*) adsorption and removal of nobler ions, thereby preventing the setting up of local elements in corrosion; (*c*) selective adsorption and stabilisation of an intermediate stage of the reaction, as in the detection of Mn with benzidine. Reactions involving gels vary with time, owing to ageing effects; those involving solids may be facilitated by using the solid in highly disperse or adsorbed form. J. S. A.

Kinetics of the reaction H_2 (gas) $\rightleftharpoons$ 2H (dissolved in Pd). C. WAGNER (Z. physikal. Chem., 1937, **181**, 244).—Priority is given to Knorr (A., 1932, 28) for the method of measuring the resistance of metallic wires described previously (A., 1932, 701). J. W. S.

Heterogeneous reactions with atomic hydrogen. II. Formation of hydrogen sulphide. III. Formation of hydrides of selenium, tellurium, and antimony. C. S. BAGDASARJAN (J. Phys. Chem. Russ., 1937, **10**, 389—400, 401—411).—II. The rate of reaction of at. H with solid S $\propto$ [H] in the extended phase. 20% of the H atoms striking the surface of the S react with it.

III. The rate of reaction of at. H with solid Se, Te, and Sb $\propto$ [H] in the extended phase. 10% of the H atoms striking the surface of Se and Te react, the corresponding figure for Sb being 11%. On the surface of Sb the probability of recombination of H atoms is <10 times as great as that of their forming SbH_3, a reaction without appreciable energy of

activation. The mechanism of the above reactions is undecided. R. C.

Rate of reaction of amalgams with acids. I. Lithium amalgam. F. A. FLETCHER and M. KILPATRICK (J. Physical Chem., 1938, **42**, 113—124; cf. A., 1934, 605).—Rates of reaction of Li amalgam in H_2O and aq. solutions of HCl, $HClO_4$, HCO_2H, AcOH, $CN\cdot CH_2\cdot CO_2H$, o-$C_6H_4Cl\cdot OH$, and Li, Na, K, Mg, Ca, Sr, and Ba chlorides have been measured at 25°. A general equation is derived. With H_2O and o-$C_6H_4Cl\cdot OH$ the velocity $\propto [Li]^{\frac{1}{2}}$, and with the other acids is independent of [Li]. F. L. U.

Dissolution of magnesium in amine salt solutions. S. BODFORSS and K. A. WALLÉN (Z. physikal. Chem., 1937, **181**, 229—238).—The velocities of dissolution of Mg in $NH_4Cl + NH_3$, and in NH_4OAc, $NHMe_3\cdot OAc$, $NH_3Et\cdot OAc$, $NH_2Et_2\cdot OAc$, and piperidine acetate at 20° are in accord with theory (A., 1931, 1373). J. W. S.

Reaction of hydrogen and oxygen atoms with solutions. P. HARTECK and K. STEWART (Z. physikal. Chem., 1937, **181**, 183—194).—H and O atoms can enter solutions to a depth of about 10^{-5} cm. and react with KI, $Na_2S_2O_3$, $K_2Cr_2O_7$, amines, etc. The heats of activation of the reactions measured range from <1 to about 5 kg.-cal. per g.-mol. The heats of dissolution of H and O atoms are $1\cdot5\pm1$ kg.-cal. per g.-atom and the solubility coeff. α_{20} is probably $0\cdot03\pm0\cdot01$. The reaction of H atoms with NH_2Ph and its derivatives has been studied in detail. 1 mol. of NH_3 is formed per 2 H atoms absorbed, the heat of activation of the reaction being 1·5 kg.-cal. per g.-mol. J. W. S.

Combustion and detonation of solid explosives.—See B., 1938, 228.

Influence of hydrogen and water vapour on the combustion of carbon monoxide mixtures. W. T. DAVID and B. PUGH (Nature, 1937, **140**, 1098).—The presence of 1—5% of H_2 or 1—2% of H_2O vapour increases the flame temp. of certain CO–air mixtures. Small quantities of H_2O and H_2 appear to reduce the no. of metastable mols. formed during the combustion of dry CO mixtures. L. S. T.

Ozone as an oxidation catalyst. XIII. Ozonation of some hydrocarbons (hexane, heptane, and various octanes). E. BRINER, C. EL-DJABRI, and H. PAILLARD (Helv. Chim. Acta, 1938, **21**, 95—108).—In presence of O_2 and at sufficiently high temp. oxidation by O_3 causes catalytic oxidation of n-C_6H_{14}, n-C_7H_{16}, n-C_8H_{18}, $CHMeEtBu^{\alpha}$, and $CH_2Pr^{\beta}Bu^{\gamma}$, furnishing yields of oxidation product corresponding with >100% of the O_3 consumed. The min. temp. for this catalytic action is the lower the higher is the mol. wt. of the hydrocarbon, but branching of the paraffin chain causes increased resistance to oxidation. J. W. S.

Acid catalysis and equilibrium constants. W. F. K. WYNNE-JONES (Trans. Faraday Soc., 1938, **34**, 245—251).—A crit. discussion of published work, with particular reference to the differentiation between general acid catalysis and sp. $H^{\cdot}$ effects. E. S. H.

Theory of proton transfer reactions. K. J. PEDERSEN (Trans. Faraday Soc., 1938, **34**, 237—244).—The general theory is discussed, especially in relation to acid and base catalysis, and applied to published data. E. S. H.

Polymerisation of propylene by dilute phosphoric acid.—See A., II, 79.

Amine catalysis of the dealdolisation of diacetone alcohol.—See A., II, 83.

Mechanism of decomposition of hydrogen peroxide by catalase. D. KEILIN and E. F. HARTREE (Proc. Roy. Soc., 1938, **B**, **124**, 397—405).—Experimental work supports a new explanation of the mechanism of decomp. of H_2O_2 by catalase, according to which the reaction is brought about by the successive reduction of catalase–Fe by H_2O_2 and its reoxidation by O_2. The reaction proceeds thus: $4Fe^{\cdot\cdot\cdot} + 2H_2O_2 = 4Fe^{\cdot\cdot} + 4H^{\cdot} + 2O_2$; $4Fe^{\cdot\cdot} + 4H^{\cdot} + O_2 = 4Fe^{\cdot\cdot\cdot} + 2H_2O$. Catalase inhibitors are separable into two groups: (1) those like KCN, H_2S, EtO_2H which inhibit the reduction of catalase–Fe by H_2O_2 and (2) those like azides, NH_2OH, and N_2H_4 which inhibit reoxidation of reduced catalase by O_2 (A., 1937, III, 30). CO in presence of even a very small concn. of O_2 does not inhibit decomp. of H_2O_2 by pure catalase preps., showing that reduced catalase has a much greater affinity for O_2 than for CO. Some catalase preps. show a more or less marked photosensitive inhibition by CO. Pure catalase preps. become sensitive to CO in presence of a very small concn. of azide, cysteine, or glutathione, which appear to inhibit reoxidation of reduced catalase. F. B. P.

Acetylcholine–cholesterolase system.—See A., III, 235.

Promoters and poisons in catalysis. S. BERKMAN, J. C. MORRELL, and G. EGLOFF (Universal Oil Products Co., Chicago, Booklet 213, 1937, 91 pp.).—A review and bibliography. R. B. C.

Inhibitors in catalysis. S. BERKMAN, J. C. MORRELL, and G. EGLOFF (Universal Oil Products Co., Chicago, Booklet, 214, 1937, 34 pp.).—A review and bibliography. R. B. C.

Ignition of gas by cold catalyst.—See B., 1938, 125.

Energy distribution of the active centres of catalysts by the adsorption of poisonous substances. M. KUBOKAWA (Rev. Phys. Chem. Japan, 1937, **11**, 202—216).—The poisoning effect of the $Hg^{\cdot\cdot}$ ion on the decomp. of H_2O_2 with Pt-black, prepared (*a*) by reduction of the oxide with H_2 at 100°, (*b*) by electrolysis of H_2PtCl_6, has been investigated. The linear relation between the reaction velocity (k) and the no. of adsorbed ions (χ) put forward by Maxted (A., 1933, 680) is not found, but $\log k \propto \log \chi$ (cf. Pease and Stewart, A., 1925, ii, 691). This relation has also been obtained theoretically by a consideration of the distribution of the active centres according to the Boltzmann principle. The distribution const. is 7·15 or 8·90 according to the prep. of the catalyst; the characteristic temp. is 170° for (*a*) and 80° for (*b*). F. J. L.

Effect of *X*-rays on catalysts in action. L. PISARSHEVSKI, S. TSCHRELASCHVILI, and G. SAVTSCHENKO (J. Phys. Chem. Russ., 1937, **10**, 534—537).—The activity of Pt or graphite which is catalysing the decomp. of aq. H_2O_2 is sometimes raised and sometimes lowered by irradiation with *X*-rays. R. C.

Catalysis of hydrogen peroxide by two catalysts. III. Decomposition of hydrogen peroxide by salts of tungsten and copper. B. A. KONOVALOVA, S. D. MONACHOVA, M. N. ANGARSKAJA, and N. P. PETIN (J. Phys. Chem. Russ., 1937, **10**, 313—324).—Neither Na_2WO_4 nor $CuSO_4$ decomposes H_2O_2 in acid solution. The catalytic action of mixtures depends on the order of, and the time between, the addition of both salts to the H_2O_2 solution. Between 10^{-2} and 2×10^{-2}N-H_2SO_4 the rate of decomp. is inversely $\propto [H^+]$. It is max. when [Cu] = 0·12 g.-atom per l. Both these rules hold also for the decomp. of Na_2WO_8 by $CuSO_4$, so that Na_2WO_8 appears to be an intermediate product of the catalysis of H_2O_2. J. J. B.

Catalysis of nitramide decomposition by colloidal platinum and gold. C. V. KING (J. Amer. Chem. Soc., 1938, **60**, 144—154).—The reaction $H_2N_2O_2 \rightarrow H_2O + N_2O$ in aq. solution is catalysed by colloidal or finely-divided Au or (especially) Pt. The activity of the catalyst varies with the method of prep. The reaction resembles the catalytic decomp. of H_2O_2. Rapid decomp. of $H_2N_2O_2$ mols. adsorbed by the particles probably occurs; the effect of "poisons" (strong acids, I, glucose, etc.) is ascribed to preferential adsorption with displacement of $H_2N_2O_2$. E. S. H.

Heterogeneous catalysis in liquid ammonia solutions. I. W. M. BURGESS and H. L. KAHLER, jun. (J. Amer. Chem. Soc., 1938, **60**, 189—192).—The slow formation of $NaNH_2$ or KNH_2 in liquid NH_3 solutions of Na or K is accelerated by many catalysts, among which platinised Pt, rusted Fe, and Ni in the form of foils, and powdered FeO have high efficiency. The catalyst is poisoned by the accumulation of $NaNH_2$ (but not KNH_2) in the solution. E. S. H.

Theory of periodic catalytic reactions. K. BENNEWITZ (Z. physikal. Chem., 1937, **181**, 151—160).—The periodic phenomena at H_2–Cl_2 electrodes in aq. HCl (cf. A., 1938, I, 142) are interpreted in relation to the theory previously advanced (A., 1932, 24). These effects are due to the simultaneous occurrence of an adsorption and two diffusion processes, which are all in different phase. The theory indicates that any catalytic process associated with periodic phenomena tends ultimately to inhibit itself. The present theory seems to be analogous to the "tunnel effect" theory, and to avoid the conceptual difficulties of the latter. R. C.

Active substances. XXIV. Preparation and catalytic activity of pure γ-FeO·OH and of the γ-Fe_2O_3 obtained therefrom. R. FRICKE and O. GLEMSER (Ber., 1938, **71**, [*B*], 158—163).—Chemically and physically homogeneous γ-FeO·OH is obtained by adding a filtered solution of $FeCl_2,4H_2O$ in H_2O to an aq. solution of $(CH_2)_6N_4$, whereby blue-green $Fe(OH)_2$ is pptd. After addition of $NaNO_2$ the mixture is heated at about 60°, whereby oxides of N are freely evolved. After 3 hr. the supernatant liquid is decanted and the residue is washed with H_2O until free from Cl′. Secondary changes become obvious if the mixture is kept for >3 hr. The product (I) has practically the same particle size as that (II), obtained by the method of Hahn and Hertrich (A., 1923, ii, 643) but is analytically pure except for a trace of C whereas Hahn's product contains S in various forms and I. (I) and the products of its dehydration at 220° and 370° have a considerably higher catalytic activity towards H_2O_2 than (II) and its corresponding products. Specimens kept in closed flasks in a desiccator retain their activity better than those kept in glass-stoppered bottles in the air; this is ascribed to the effect of atm. moisture penetrating around the stoppers. The catalytic activity of (I) is greatly diminished after it has been treated with a solution of S in CS_2 or mixed with $Na_2S_2O_3$ + I, thus explaining the lower activity of (II). Adsorptive H_2O, united at the active positions, diminishes the catalytic activity of γ-FeO·OH towards H_2O_2. H. W.

Ammonia synthesis at atmospheric pressure. V. A. PLOTNIKOV and V. A. KIKETZ (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 155—167).—Various catalysts for the synthesis of NH_3 are described. K. S.

Reduction of iron catalysts for ammonia synthesis.—See B., 1938, 159.

Cause of loss of platinum in oxidation of ammonia.—See B., 1938, 159.

Catalytic interaction of ethylene and heavy hydrogen on platinum. A. FARKAS and L. FARKAS (J. Amer. Chem. Soc., 1938, **60**, 22—28).—The interaction has been studied at 10—100 mm. and 0—236°. Hydrogenation and exchange occur, according to (*a*) $C_2H_4 + D_2 = C_2H_4D_2$ and (*b*) $C_2H_4 + D_2 = C_2H_3D + HD$. At 0—150°, (*a*) has a temp. coeff. >1 and activation energy 10 kg.-cal.; at temp. >150° the temp. coeff. is <1. Comparison of (*a*) with the ortho–para conversion of H_2 and D_2 and with the reaction $H_2 + D_2 \rightleftharpoons 2HD$ shows that in the lower temp. range the rate-determining step is the activation of H_2 mols., which involves the loosening of the linking between their atoms. The temp. coeff. of (*b*) is > that of (*a*), and the activation energy is 22 kg.-cal. The rate-determining step of (*b*) is $C_2H_4 \rightarrow C_2H_3 + H$; the temp. coeff. of hydrogenation above 150° is due to the shifting of equilibrium in the direction $C_2H_3 + H$, owing to the high temp. coeff. of the rate-determining step. E. S. H.

Decomposition of methane on the surface of platinum. M. KUBOKAWA (Rev. Phys. Chem. Japan, 1937, **11**, 217—219).—The retardation exponent (cf. A., 1937, I, 573) is explained quantitatively. It is >1 and varies according to the nature of the catalyst. F. J. L.

Catalytic polymerisation of butylenes by sulphuric acid.—See B., 1938, 135.

Effect of alkali on copper methyl alcohol catalysts. D. A. POSPECHOV and A. A. SCHOKOL

(Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 205—213).—The synthesis of MeOH and EtOH from CO and H_2 with the catalysts $Cu_{60}(ZnO)_{35\cdot6}(Cr_2O_3)_{4\cdot4}$ and $Cu_{82}(ZnO)_{16}(Cr_2O_3)_2$ containing 0·1—5 mol.-% of alkali hydroxide, at pressures $\geq$100 atm. and temp. <200°, is described. Increase in the flow velocity increases the yield of EtOH up to 22% of the crude condensate. The second catalyst proved the more efficient. K. S.

Decomposition of methyl alcohol by catalysts used in its synthesis.—See B., 1938, 135.

Catalysts for vapour-phase oxidation of acetaldehyde.—See B., 1938, 135.

Simultaneous catalytic preparation of acetic acid and ethyl acetate from ethyl alcohol.—See B., 1938, 135.

Catalytic activity of cobalt mixed with certain metals for gas-phase reduction of nitrobenzene to aniline. F. A. GRIFFITTS and O. W. BROWN (J. Physical Chem., 1938, **42**, 107—111).—Yields are recorded for Co, Co–Mn, Co–Mo, and Co–Cr catalysts, alone or supported on asbestos. Co–Mn gave the highest yield (99% at 260°) but is sensitive to temp. Co–Mo gave 89% at 320°. The others were relatively inefficient. F. L. U.

Catalytic reduction of tar phenols to benzene hydrocarbons.—See B., 1938, 127.

Rate of decomposition of tetralin peroxide. V. Effect of pro-oxidant on the rate of decomposition. T. YAMADA (J. Soc. Chem. Ind. Japan, 1937, **40**, 422—424B; cf. B., 1936, 355).—The influence of oleates of Mn, Co, and Pb on the decomp. rate of tetralin peroxide at 80—130° has been studied. The original first order reaction is changed by Mn and Co oleates to a reaction of the second order, and by Pb oleate to one of the third order. The increase in order is explained by supposing that the driers are partly consumed during the reaction. R. S. B.

Recent developments in the contact sulphuric acid process.—See B., 1938, 158.

Application of niobium and tantalum oxides in the [sulphuric acid] contact process.—See B., 1938, 158.

Contact catalytic activity of chromium oxide in oxidation of sulphur dioxide to sulphur trioxide.—See B., 1938, 159.

Electrolytic separation of hydrogen and deuterium and the catalysed exchange reaction HD + H_2O = H_2 + HDO. J. A. V. BUTLER (Z. Elektrochem., 1938, **44**, 55—60).—It is considered probable that at irreversible electrodes separation of H and D is due to differences in the velocities of transfer of electrons from the metal to hydrated ions. At reversible electrodes the velocities of adsorption of protons and deuterons, combination of atoms, and desorption as mols. also enter into the mechanism, but the product of electrolysis is the equilibrium gas. A mechanism is developed for the reversible H_2 electrode, based on measurements of the reaction HD + H_2O = H_2 + HDO. J. W. S.

Electrodeposition of copper–nickel alloys.—See B., 1938, 177.

Chromium electroplating of aluminium.—See B., 1938, 177.

Electrolytic production of white lead.—See B., 1938, 189.

Chemical action of electric discharges. XII. Production of hydrocyanic acid by the electric arc at different frequencies. E. BRINER, J. DESBAILLETS, and H. PAILLARD. **XIII. Spectroscopic examination of a nitrogen–oxygen mixture (air) submitted to the action of the electric arc at different frequencies.** E. BRINER, B. SIEGRIST, and B. SUSZ. **XIV. Spectroscopic examination of methane–nitrogen–hydrogen mixtures submitted to the electric arc at different frequencies.** E. BRINER, J. DESBAILLETS, and B. SUSZ (Helv. Chim. Acta, 1938, **21**, 115—133, 134—137, 137—140).—XII. The yield of HCN produced by the action of an a.c. arc on CH_4–N_2–H_2 mixtures at atm. pressure increases with increasing frequency (n), reaching about 43 g. per kw.-hr. at $n = 10^7$ cycles per sec. Reduction of pressure does not improve the yield, but diminishes the deposition of C on the electrodes. The simultaneous production of NH_3 is greatly increased by reduction of pressure. The increased yield at high frequency is attributed to the possibility of maintaining a stable arc of much lower power, causing less loss of HCN and NH_3 through thermal decomp.

XIII. N_2–O_2 mixtures, excited by an a.c. arc, show the same N_2 and NO bands at all vals. of n, but the intensities of the bands in the short-λ region increase with increasing n, causing an extension of the spectrum into the ultra-violet region. The N_2^+ bands also increase in intensity with increasing n.

XIV. CH_4–N_2–H_2 mixtures, excited by an a.c. arc, show the Swan spectrum of C, the CN bands, and the spectra of N_2 and N_2^+. The same particles are present at all vals. of n, but formation of C prevents quant. observations of variations in the band intensities. J. W. S.

Grotthuss and Einstein. W. D. BANCROFT and R. C. CLAPP (J. Franklin Inst., 1938, **225**, 23—43).—A discussion of the advances in photochemical theory since the time of Grotthuss. The photochemical decomp. of Fehling's solution and M-$CuSO_4$ in the presence of quinol is investigated. F. J. L.

Effect of life of gas ions on their chemical activity. P. GÜNTHER and L. HOLZAPFEL (Z. physikal. Chem., 1937, **B**, **38**, 211—220; cf. A., 1936, 1473).—If a H_2–O_2 mixture or NH_3 is sensitised for ionisation by X-rays by the presence of Xe, the amount of reaction per pair of ions is the same, irrespective of whether the ions are allowed to combine soon after their formation or are electrolysed out in the saturation current after traversing a certain distance. It is inferred that there is no connexion between the life of the ions and their activity. R. C.

Photochemical investigations in the Schumann ultra-violet. V. Photochemical decomposition

of methane. W. GROTH (Z. physikal. Chem., 1937, **B**, **38**, 366—380).—The absorption by CH_4 at atm. pressure of radiation of λλ 1470 and 1295 A. has been investigated. Approx. 0·35 mol. of H_2 is formed per quantum by decomp., the rate being uninfluenced by increase in the no. of quanta absorbed. On the other hand, the yield of hydrocarbon decreases from 0·17 to 0·10 mol. per quantum with increase in the no. of quanta absorbed. A study of the v.p. curves of the decomp. products shows that C_2H_2, C_2H_4, and C_2H_6 are formed in varying proportions according to the conditions. A mechanism for the decomp. is discussed. C. R. H.

Mechanism of optical sensitising of silver halides by dyes. S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (Nature, 1937, **140**, 1096—1097).—In approx. monochromatic light of 5460 A. and with a simple Ag halide hydrosol, stabilised with a slight excess of Br′ and sensitised with erythosin, the dye is destroyed progressively with exposure to light, and the no. of Ag atoms formed is from 1 to 2 per mol. of dye that disappears. The dye also disappears on exposure to the blue-violet light adsorbed by AgBr when the green light adsorbed by the Ag halide–erythosin complex is eliminated. With halogen acceptors present in green light (5460 A.), the adsorbed dye is not destroyed by the light adsorbed, but Br′ is converted into Br, and Ag· into Ag, progressively with exposure. For erythosin, all the dye mols. adsorbed are not active photolytically; the amount of Ag produced by a given exposure increases rapidly at first and then reaches a limit before adsorption saturation. The optically sensitising dye facilitates the transfer of an electron from Br′ to Ag· without itself undergoing decomp. L. S. T.

Herschel effect. F. G. PERSON and J. M. BLAIR (J. Franklin Inst., 1938, **225**, 73—80).—The regression of the latent photographic image under the influence of light of $\lambda > 0{\cdot}64$ mμ. at −22°, 20°, 50°, and 100° is investigated. The Herschel effect, for a given val. of intensity × exposure (secondary illumination), increases as the intensity decreases. F. J. L.

Spectral sensitivity and light absorption of dye-sensitised photographic emulsions. J. A. LEERMAKERS, B. H. CARROLL, and C. J. STAUD (J. Chem. Physics, 1937, **5**, 878—888).—Light absorption and sensitivity curves for emulsions sensitised with certain cyanine dyes show a correspondence in the region of colour-sensitising. The absorption curves of AgBr dyed with some cyanine dyes and those of the dyes in saturated solutions of inorg. salts are essentially the same. Two types of adsorption on AgBr are indicated since such an emulsion shows sensitivity in different spectral regions corresponding with the light absorption characteristics of the dye adsorbed in the aggregated and mol. states. W. R. A.

Quantitative relationships between light absorption and spectral sensitivity of dye-sensitised photographic emulsions. J. A. LEERMAKERS (J. Chem. Physics, 1937, **5**, 889—892).—Quant. measurements on orthochromatic and panchromatic films between 4000 and 7000 A. show good correspondence between light absorption and sensitivity of the dyed AgBr emulsion over the whole range for the panchromatic film, the orthochromatic film being less sensitive in the green than in the blue for equal absorption. Energy transfer from the dye to the Ag halide is very efficient for the panchromatic sensitising. Possible sensitising mechanisms are discussed. W. R. A.

Surface-dye concentration relationships in sensitised photographic emulsions. J. A. LEERMAKERS, B. H. CARROLL, and C. J. STAUD (J. Chem. Physics, 1937, **5**, 893—896).—The amount of dye producing max. sensitising is ∝ the Ag halide surface. At optimum sensitising concn. the dye is adsorbed to the Ag halide in a unimol. layer. W. R. A.

Becquerel effect of copper oxide electrode in alkali solution. N. HAYAMI (Rev. Phys. Chem. Japan, 1937, **11**, 166—188).—The photochemical reaction $2CuO \rightleftharpoons Cu_2O + 0{\cdot}5O_2$ has been studied by means of the Becquerel effect. The time taken to reach equilibrium of the Becquerel effect is independent of the intensity and λ of the light (430—540 mμ.). The equilibrium photo-voltaic potential ∝ the light intensity, the max. electrode p.d. being observed at λ 450—500 mμ., and decreases with rise in temp. (0—45°). The results are considered thermodynamically and it is shown that the reaction in the dark is of first order, and the photochemical reaction is of zero order. F. J. L.

Influence of light on corrosion of iron.—See B., 1938, 159.

Photochemical reactions with inorganic colloids as active agents under the influence of light in various states of polarisation. I. Tungstic acid, molybdic acid, chromium tungstate, etc. as photo-reactive agents. Optical properties of these sols; circular dichroism in the ultra-violet. J. C. GHOSH, T. BANERJEE, and S. K. MUKHERJEE. **II. Photochemical reduction of tungstic acid sol by glucose, fructose, formaldehyde, lactic acid, sodium hypophosphite, leucine, and glutamic acid.** J. C. GHOSH, T. BANERJEE, S. K. BHATTACHARYYA, and S. K. DAS-GUPTA. **III. Effect of p_H on photo-reduction of tungstic acid sol in unpolarised light.** J. C. GHOSH, T. BANERJEE, and M. S. A. KHAN. **IV. Photochemical reduction of molybdic acid sol by glucose, formaldehyde, ethyl alcohol, sodium hypophosphite, leucine, glutamic acid, and α-alanine.** J. C. GHOSH, T. BANERJEE, K. M. BHATTACHARYYA, and M. S. A. KHAN. **V. Effect of p_H on photo-reduction of molybdic acid sol in unpolarised light.** J. C. GHOSH, T. BANERJEE, and M. S. A. KHAN. **VI. Photochemical reduction of vanadic acid sol with ethyl alcohol in acid medium.** J. C. GHOSH, T. BANERJEE, and S. K. BHATTACHARJEE. **VII. Photochemical reduction of uranic acid sol by sodium tartrate.** J. C. GHOSH, T. BANERJEE, and J. C. BOSE. **VIII. Internal filter action of reduced tungstic acid and molybdic acid sols.** T. BANERJEE and J. C. GHOSH. **IX. Photochemical oxidation of alcohol and glucose by iodine in acid medium with**

tungstic acid sol as photosensitiser. J. C. GHOSH, T. BANERJEE, S. K. NANDY, and N. GUPTA. **X. Photochemical oxidation of glucose by potassium indigotintetrasulphonate with tungstic acid sol as photocatalyst.** J. C. GHOSH, T. BANERJEE, and S. K. BHATTACHARJEE. **XI. Photochemical oxidation of glucose by methylene-blue with uranic acid sol as photosensitiser.** J. C. GHOSH, T. BANERJEE, and J. C. BOSE. **XII. Photochemical oxidation of glucose and fructose by methylene-blue with ferric hydroxide sol as photosensitiser.** T. BANERJEE, S. K. BHATTACHARJEE, and N. MUKHERJEE. **XIII. Influence of state of polarisation of light on velocity of photo-oxidation of organic substances by hydrogen peroxide with colloids as photosensitisers.** T. BANERJEE. **XIV. Influence of circularly polarised light on photochemical reactions with pre-excited colloids as photosensitisers.** J. C. GHOSH and T. BANERJEE (J. Indian Chem. Soc., 1937, **14**, 495—518, 519—530, 531—538, 539—546, 547—550, 551—558, 559—563, 575—580, 581—588, 589—596, 597—602, 603—610, 611—616, 617—626).—I. Optical and photochemical properties of sols of V_2O_5, WO_3, MoO_3, and UO_3 are described. The anisotropy factor was determined for sols matured 10 hr. in the dark and in unpolarised, plane-polarised, and *d*- and *l*-circularly polarised light. For WO_3, V_2O_5, and Cr tungstate sols a positive factor was found after maturing in *l*- and a negative factor after maturing in *d*-circularly polarised light. With these sols matured under other conditions, and with the remaining sols under all conditions, no anisotropy factor was detected. Light of λ 366 mμ. was used.

II. All the reductions studied are zero-mol. with respect to the WO_3 sol, and the velocity coeff. (*k*) is ∝ the light energy absorbed. The quantum yield varies between 1·0 and 0·1, and under otherwise identical conditions is higher in *l*- than in *d*-circularly polarised light (λ 366 mμ.). A mechanism is suggested which is in harmony with the observed linear relation between $1/k$ and 1/reductant concn.

III. The quantum efficiency in the photo-reduction of WO_3 sol increases from 0 at p_H 4·8 to a max. about p_H 1·3. The effect is attributed to micelle formation in the sol, complicated by a second factor in the case of NH_2-acids.

IV. The results with MoO_3 sol are the same as with WO_3, except that *d*- and *l*-circularly polarised light are equally effective.

V. The effect of change of p_H on the photo-reduction of MoO_3 sols is described and considered to be related to the different types of micelle anions formed.

VI. The effect of p_H on photo-reduction of V_2O_5 sol by EtOH is in the opposite sense to that observed with WO_3 and MoO_3. The velocity coeff. is not ∝ intensity of radiation or (intensity)$^{\frac{1}{2}}$. In other respects the results are the same as for WO_3, but the quantum yield is $\ll 1$.

VII. The rate of photochemical reduction of UO_3 sol by Na tartrate $= k(a - x)/a$, where a = initial $[UO_3]$. k is ∝ the absorbed radiation. The quantum efficiency is $<1>0{\cdot}5$.

VIII. In the photo-reduction of WO_3 and MoO_3 sols the reduced W or Mo compounds are themselves non-photo-active, and their extinction coeff. is > that of the original sol. In spite of this the velocity of reduction remains unaffected. An explanation based on the two-dimensional mobility of the adsorbed mols. (cf. A., 1932, 688), in consequence of which radiation energy absorbed by the latter is imparted to the underlying photo-active substrate, is offered and supported by experiments.

IX. There is no photochemical reaction between I and EtOH or glucose in acid solution in the absence of a photo-catalyst. The reaction in presence of colloidal WO_3 has been studied with respect to the influence of concn., p_H, temp., intensity and state of polarisation of light. The results are in harmony with the assumption that radiation energy absorbed by the WO_3 is communicated to the adsorbed I mols., which are thereby dissociated into atoms.

X. A similar study of the oxidation of glucose by Na indigotintetrasulphonate shows this reaction to have a more complex velocity coeff. and a quantum efficiency $\ll$ that of the I–glucose reaction. The differences are due to the adsorption at the sol surface of mols. of leuco-dye which are photo-inactive.

XI. The photo-oxidation of glucose by methylene-blue in presence of UO_3 sol is zero-mol. with respect to the oxidant, the velocity is ∝ light intensity, and independent of $[UO_3]$ if the incident radiation is completely absorbed. The quantum efficiency is about 1.

XII. With colloidal $Fe(OH)_3$ as photosensitiser the oxidation of glucose and fructose by methylene-blue is attended by long induction periods, and the quantum efficiency is $\ll 1$. Otherwise the reaction is similar to that with UO_3. Explanations are offered.

XIII. Photo-oxidation of glucose, fructose, or CH_2O in circularly polarised light in presence of sols of WO_3, MoO_3, V_2O_5, Cr tungstate, and $Cr(OH)_3$ is attended by induction periods of 6—8 hr. With WO_3, V_2O_5, and Cr tungstate *l*- is more efficient than *d*-circularly polarised light, whilst with MoO_3 and $Cr(OH)_3$ the efficiencies are equal.

XIV. Induction periods observed in reactions brought about by circularly polarised light (c.l.) disappear when the photo-active sol (WO_3 etc.) has been exposed to radiation for a sufficient time before mixing with the other reactants. The difference between the efficiency of *l*-c.l. and *d*-c.l. with certain sols is observed only when the sol has been pre-excited in light of the same state of polarisation as that used in the subsequent photochemical reaction. The only sols for which such a difference is observable are those which exhibit circular dichroism when exposed to *d*- or *l*-c.l., and are also those in which the micelles have been shown to possess a microcryst. structure. It is inferred that c.l. exercises a directive influence during the formation of the cryst. aggregates, whereby an anisotropic lattice structure is developed. F. L. U.

Photochemical reactions in the fluorite region. II. Photochemical decomposition of formaldehyde vapour. R. G. W. NORRISH and W. A. NOYES (Proc. Roy. Soc., 1937, **A**, **163**, 221—227).—The products of decomp. in the Schumann region are

mainly H_2 and CO, no evidence being found for primary dissociation into CH_2 radicals and O atoms. G. D. P.

Photolysis of azomethane. III. Effect of nitric oxide and the nature of the primary step. T. W. DAVIS, F. P. JAHN, and M. BURTON (J. Amer. Chem. Soc., 1938, **60**, 10—17; cf. A., 1937, I, 419, 627).—Analysis of the products of photolysis shows that when NO is present practically no alkane gas is produced. Decomp. occurs almost exclusively according to $NMe{:}NMe + h\nu \rightarrow 2Me + N_2$, the Me radicals subsequently combining with Me_2N_2 mols. to yield more complicated radicals and mols., which give C_2H_6 and other alkanes by further decomp. The existence of a thermally unstable compound formed by the interaction of NO with the products of photolysis is discussed. E. S. H.

Formation of benzene in the radiochemical polymerisation of acetylene. II.—See A., II, 80.

Exchange reactions between light and heavy hydrogen. C. K. INGOLD and C. L. WILSON (Z. Elektrochem., 1938, **44**, 62—71).—A review. These reactions are classified into exchanges dependent on homogeneous ionisation, direct homogeneous exchange between mols., homogeneous exchanges with H atoms, and heterogeneous exchanges under the influence of surface catalysts, and the possible mechanisms of each type are discussed. It is suggested that many direct homogeneous exchanges between mols. take place through a transition state belonging to the 4-atom problem, *e.g.*, $:CH + DO{\cdot}SO_3H \rightarrow :C<^{H}_{D}>O{\cdot}SO_3H \rightarrow :CH + DHSO_4$ or $\rightarrow :CD + H_2SO_4$. Evidence in favour of this theory is discussed. J. W. S.

Preparation of deuterium compounds. H. ERLENMEYER (Z. Elektrochem., 1938, **44**, 8—13).—A summary of the methods which have been used for prep. of inorg. and org. D compounds. J. W. S.

Active hydrogen, oxygen, and nitrogen at pressures up to 20 mm. P. HARTECK and E. ROEDER (Z. physikal. Chem., 1937, **181**, 195—196; cf. A., 1937, I, 316).—A reply to Klemenc (A., 1937, I, 526). J. W. S.

Method and apparatus for the rapid conversion of deuterium oxide into deuterium. J. W. KNOWLTON and F. D. ROSSINI (J. Res. Nat. Bur. Stand., 1937, **19**, 605—612).—D_2O vapour, evaporated in a vac., is passed over Mg at 480°, the D_2 evolved being passed through a liquid air filter-trap and collected as liquid in a vessel immersed in liquid H_2. It is subsequently allowed to vaporise and fill gas cylinders at room temp. 95% yield is claimed. J. W. S.

Combustion of hydrogen and lower paraffin hydrocarbons over cupric oxide.—See B., 1938, 130.

Preparation of soft water comparable with distilled water, by ionic exchange. G. AUSTERWEIL and A. FIEDLER (Compt. rend., 1937, **205**, 1235—1237).—The H_2O passes successively over a H· exchanger (lignite treated with H_2SO_4) which replaces salts by the corresponding acids, through a degasifier to remove CO_2, and over an insol. org. base (*e.g.*, a quinone-imine complex) which ppts. the acids as insol. salts. The H· exchanger is regenerated with dil. acid, and the base with dil. alkali. A. J. E. W.

Ammoniated copper sulphates. E. RENCKER (Bull. Soc. chim., 1937, [v], **4**, 1992—1995).—$CuSO_4,5NH_3$ has been prepared by the action of NH_3 on anhyd. $CuSO_4$; $CuSO_4,4NH_3,H_2O$ by pptg. ammoniacal $CuSO_4$ with EtOH. A dilatometric study of the thermal decomp. of these compounds shows arrests at the compositions $CuSO_4,2NH_3$ and $CuSO_4,NH_3$. E. S. H.

Complex compounds of picric acid and other nitrophenols with cuprammonium salts.—See A., II, 94.

Structure, energy content, and other properties of active substances. XXIII. Examination of active MgO, γ-Al_2O_3, γ-Fe_2O_3, and ZnO by Otto Hahn's emanation method. Comparison of the results with those of other methods of measurement. R. FRICKE and C. FEICHTNER (Ber., 1938, **71**, [*B*], 131—144).—Dehydration at various temp. of defined hydroxides indexed with a little radio-Th gives active preps. of MgO, γ-Fe_2O_3, and ZnO. For these specimens determination is made of the emanating power (*EmV*) according to Hahn, *i.e.*, the % of the Th emanation (I) formed which the specimen can lose with relative ease. Comparison of the results thus obtained [taking into account the different rebound lengths of (I)] among themselves and with the results of other röntgenographic determinations of particle size leads to the following conclusions. Even with primary particle size under the rebound length of (I) *EmV* vals. of $<100\%$ and even $\ll 100\%$ are found. These observations harmonise with those made previously which establish the influence of the density of packing of finely-divided preps. on the escape of (I). Intergrowths and "baking" of the primary particles are also important factors. In these cases Hahn's method gives a profound insight into the secondary structure. The secondary structure of Mg oxides obtained at lower temp. is invariably considerably looser than that of the initial material and this property increases with decrease in the particle size of the initial material. Adsorption of H_2O and CO_2 by the active MgO increases *EmV*, which is diminished by chemical union with MgO. Combination of CO_2 and $Mg(OH)_2$ increases the *EmV*. With increased temp. and duration of heating the *EmV* declines; prolongation of heating at 350—400° has a noticeable effect in this connexion. Preps. of γ-Fe_2O_3 have all been obtained at moderate temp. from γ-FeO·OH, the primary particle size of which is $<$ the rebound length of thoron. The loosening of the secondary structure of the product in comparison with that of the initial material is slight. After protracted or more intense heating (200—400°) a moderate compression of the secondary structure is obvious. The active Zn oxides are obtained partly by dehydration of coarsely cryst. ε-$Zn(OH)_2$ at lower temp., partly by direct pptn. from solution. All have a low *EmV*. With the prep. obtained by the former method there is a slight

increase in *EmV* over that of the initial material. Previous röntgenographic investigations of active Zn oxides obtained by corresponding methods have indicated very high particle sizes ≫ rebound lengths of thoron so that it must be assumed that the emanation method indicates the primary particle size and so confirms the previous röntgenographic observations. H_2O adsorbed by γ-Al_2O_3 causes an increase in *EmV*. H. W.

Complexes of magnesium chloride with organic compounds containing oxygen.—See A., II, 80.

Preparation of tricalcium aluminate hexahydrate. A. TRAVERS and M. ZAHABI (Compt. rend., 1937, **205**, 1407—1409).—Pure $3CaO,Al_2O_3,6H_2O$ is pptd. on addition of an alkaline solution of $K_2O,Al_2O_3,3H_2O$ (I) to boiling $Ca(OPh)_2$ solution, CO_2 being excluded. The alkalinity of the (I) solution is calc. just to neutralise the free PhOH formed in the reaction. A. J. E. W.

Properties of tricalcium aluminate hexahydrate and of anhydrous tricalcium aluminate. A. TRAVERS and H. ZAHABI (Compt. rend., 1938, **206**, 55—57; cf. preceding abstract).—Dehydration of $3CaO,Al_2O_3,6H_2O$ (I) by heating gives the dihydrate at 275—450°, and is complete at 1000°; no decomp. occurs at <1100°. Boiling with NH_4Cl in EtOH solution gives no NH_3, indicating the absence of weakly bound CaO. (I) and $3CaO,Al_2O_3$ (II) give congruent aq. solutions, that of (II) being strongly supersaturated with respect to (I); the solutions deposit cubic (I) on evaporation at >25°, and a hexagonal higher hydrate in vac. at <25°. Hydration of (II) occurs with evolution of heat, and without separation of $Ca(OH)_2$. A chloroaluminate and sparingly sol. $3CaO,Al_2O_3,2{\cdot}5CaSO_4,28—29H_2O$ are pptd. from aq. solutions of (II) by $CaCl_2$ and $CaSO_4$, respectively. (I) and (II) are derived from $Al(OH)_3$, which behaves similarly on dehydration. A. J. E. W.

Separation of pure strontium isotope 87 from an old lepidolite containing rubidium and the half-life period of rubidium. F. STRASSMANN and E. NALLING (Ber., 1938, **71**, [*B*], 1—9; cf. Hahn *et al.*, A., 1937, 210; Mattauch, A., 1937, 210).—Fuller details are given of the prep. of 263·4 mg. of $SrCO_3$ (= 156 mg. Sr) from 1012 g. of a Canadian mica. The product is almost exclusively ^{87}Sr obtained by β-disintegration of ^{87}Rb. The half-life of the mixed element is $2{\cdot}3 \times 10^{11}$ years and that of ^{87}Rb is $6{\cdot}3 \times 10^{10}$ years. For the prep. of Sr from minerals containing Rb the materials are fused with Na_2CO_3 and treated with HCl; after the SiO_2 has been rendered insol., according to the amount of the material 1—4 g. of Ba is pptd. in the solution as $BaSO_4$ without previous removal of SiO_2. After complete pptn. the $BaSO_4 + SiO_2$ are collected on a hardened filter and treated with $HF + H_2SO_4$. After removal of HF the residue is dissolved in very dil. HCl and after renewed addition of Ba the remainder of the Sr (previously adsorbed by the SiO_2) is pptd. The insol. sulphates are fused with Na_2CO_3, impurities such as Fe are removed by the usual analytical methods, and $SrCl_2$ and $BaCl_2$ are separated by treatment with EtOH and HCl. H. W.

Mercurous and mercuric antimonates. E. MONTIGNIE (Bull. Soc. chim., 1937, [v], **4**, 2086).—$Hg_2HSbO_4,7H_2O$ is formed by interaction of K_2HSbO_4 and $Hg^{\cdot}$ salts; with $Hg^{\cdot\cdot}$ salts the product is $Hg_2(HgO)SbO_4$, or from hot or dil. solutions $HgHSbO_4,5HgO,H_2O$. The compounds are decomposed by heat, yielding Sb_2O_4. E. S. H.

Compounds of aluminium bromide with silver and potassium bromides. V. A. PLOTNIKOV and V. I. MICHAILOVSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 121—124)—The complex *salts* $AlBr_3,AgBr$, m.p. 175°, and $AlBr_3,KBr$, m.p. 170—173°, were obtained from mixed solutions of the simple salts in EtBr and PhCl, respectively. K. S.

Thallous chloride. E. MONTIGNIE (Bull. Soc. chim., 1937, [v], **4**, 2085).—The reactions of TlCl with aq. solutions have been examined. TlCl and $PbCl_2$ can be separated by treatment with hot aq. Na_2CO_3, in which TlCl is sol. E. S. H.

Acetometallates. I. Acetoplumbites. A. LEHRMAN and E. LEIFER (J. Amer. Chem. Soc., 1938, **60**, 142—144).—The liquidus curve of the system $KOAc–Pb(OAc)_2$ has been determined, and the existence of $KOAc,Pb(OAc)_2$, $2KOAc,Pb(OAc)_2$, and $KOAc,2Pb(OAc)_2$ (I) established. The analogy between these compounds and the hydroxyplumbites is discussed. (I) appears to be derived from an acid of the formula $H[Pb_2(OAc)_5]$. E. S. H.

Concentration of ^{15}N by chemical methods. H. C. UREY, J. R. HUFFMAN, H. G. THODE, and M. FOX (J. Chem. Physics, 1937, **5**, 856—868).—Chemical exchange reactions involving NH_3 as the gas phase and solutions of NH_3 in H_2O and MeOH, and of NH_4NO_3 and $(NH_4)_2SO_4$ in H_2O as the liquid phase, are used to concentrate ^{15}N. The best method is by exchange between $(NH_4)_2SO_4$ solutions and NH_3 gas, and in this way considerable quantities of N_2 of high $[^{15}N_2]$ have been obtained. W. R. A.

Action of nitric acid on amidosulphonic acid. Simple preparation of nitrous oxide. P. BAUMGARTEN (Ber., 1938, **71**, [*B*], 80—81).—$NH_2{\cdot}SO_3H$ and 100% HNO_3 evolve gas violently at room temp. and the change cannot be stopped by cold H_2O. With 93% HNO_3 the reaction commences after some time whereas with 73% acid gentle warming is required. The change is then quant. and the liberated nitrous oxide is pure: $HNO_3 + NH_2{\cdot}SO_3H = N_2O + H_2O + H_2SO_4$. H. W.

Phosphonitrile oxide, $(OPN)_n$. G. WETROFF (Comp. rend., 1937, **205**, 668—670).—$(OPN)_n$ (I) is formed as a white non-volatile amorphous solid, insol. in ordinary solvents, by the action of $POCl_3$ on liquid NH_3; the product is heated to expel NH_4Cl etc., the last traces being removed by heating in a vac. at 500—525° for several days. (I) may be heated at 750° in a vac. without decomp. Hydrolysis at 175° slowly gives $NH_4H_2PO_4$, intermediate formation of metaphosphimic acids not being detected. Thermal decomp. at 1000° gives P_2O_5, P_2O_3, N_2, and impure $(PN)_n$. A. J. E. W.

Preparation of diammonium dihydrogen pyrophosphite. S. J. KIEHL and M. F. MOOSE (J. Amer. Chem. Soc., 1938, **60**, 47—49).—$(NH_4)_2H_2P_2O_5$ has been prepared by dehydrating $NH_4H_2PO_3$ with BaO in vac. at 100—120°. $(NH_4)_2H_2PO_5$ decomposes when heated at >130° for a long time; it is very sol. in H_2O. E. S. H.

Fractionation of oxygen isotopes by distillation of water. A. I. BRODSKI, V. A. ALEXANDROVITSCH, and O. K. SKARRE (J. Phys. Chem. Russ., 1937, **10**, 538—539).—Preliminary experiments are described. R. C.

Chlorosulphonate chlorides. III. Action of sulphur trioxide on trichlorides of elements of group V of the periodic system. A. I. LICHATSCHEVA (J. Gen. Chem. Russ., 1937, **7**, 2298—2300).—$SbCl_3$ or $BiCl_3$ and SO_3 yield $SbCl(SO_3Cl)_2$ and $Sb(SO_3Cl)_3$ or $BiCl_2{\cdot}SO_3Cl$ and $BiCl(SO_3Cl)_2$. R. T.

Reactions of chromates at high temperatures. III. Decomposition of calcium chromate. V. T. ATHAVALE and S. K. K. JATKAR (J. Indian Inst. Sci., 1937, **20 A**, 55—66; cf. A., 1927, 326).—$CaCrO_4$ is decomposed in four stages (50, 66·6, 75, and 80%), the ranges of temp. over which these are stable being 800—850°, 850—920°, 920—1080°, and 1080—1125°, respectively. At higher temp. and low pressures, $CaCrO_4$ is decomposed completely. The v.p. of these stages have been measured and the heats of decomp. calculated. During the successive stages of decomp. the following compounds are formed: $8CaO,4CrO_3,2Cr_2O_3$; $9CaO,4CrO_3,Cr_2O_3$; $17CaO,6CrO_3,2Cr_2O_3$; $3CaO,CrO_3Cr_2O_3$; $3CaO,CrO_3,2Cr_2O_3$; $8CaO,2CrO_3,3Cr_2O_3$, and $10CaO,6CrO_3,Cr_2O_3$. These compounds are more stable than the pure $CaCrO_4$. A Mo wire-wound furnace is described. D. F. R.

Aqueous solutions of some chromic salts. II. Modified green chromic sulphate, "ol green chromic chloride," and green chromic sulphate. H. SUEDA (Bull. Chem. Soc. Japan, 1937, **12**, 524—536; cf. A., 1935, 1202).—When heated at 90° the violet sulphate yields green Cr^{III} sulphate (I); when boiled in aq. solution it yields modified green Cr^{III} sulphate (II). When heated with 1 equiv. of NaOH the violet chloride yields "ol green chromic chloride" (III). The nature and changes of these complexes with time, dilution, heating, and alkali addition are investigated by determination of SO_4'', electrometric titration, and absorption spectra. The following structures are accorded: (II), $[X(OH)(SO_4)_2X]_2SO_4$ (0·06M), $[Y(OH)(SO_4)Y]_2(SO_4)_3$ (0·0006M); (III), $[Y(OH)_2Y]Cl_4$, where $X = (H_2O)_3Cr$, $Y = (H_2O)_4Cr$. I. McA.

Complex salts of amino-acids and peptides. III. Salts of dioxalatodipyridinochromiato-acid (dioxpyridic acid) and dioxalatodianilinochromiato-acid (dioxanilic acid). M. BERGMANN (J. Biol. Chem., 1938, **122**, 569—576; cf. A., 1935, 737).—The following *salts* of dioxpyridic acid, $[Cr(C_2O_4)_2(C_5H_5N)_2]H$, are described: NH_2Ph, Na, NH_4, glycine (I), *dl*- and *l*-alanine (II), *l*-valine, *l*-leucine, *l*-cysteine, *l*-cystine, *dl*- and *l*-phenylalanine, *l*-tyrosine, *l*-proline (III), *l*-asparagine, and *l*-arginine. In protein hydrolysates containing (I) and (II) and only small amounts of (III), (I) and (II) can be determined by K trioxalatochromiate and Na dioxpyridate, respectively. The NH_2Ph, Na, NH_4, glycine, *l*-tyrosine, and *l*-arginine *salts* of "dioxanilic acid" are described. J. N. A.

Uranyl orthoarsenates. J. KRAFT (Compt. rend., 1938, **206**, 57—59).—The reactions between aq. solutions of $UO_2(OAc)_2$ and H_3AsO_4 and some orthoarsenates have been investigated conductometrically and by analysis of solid products. Addition of H_3AsO_4 to $UO_2(OAc)_2$ gives a ppt. of $(UO_2)_3(AsO_4)_2$ (I); addition of $UO_2(OAc)_2$ to H_3AsO_4, however, gives UO_2HAsO_4 (II), which reacts with excess of $UO_2(OAc)_2$ giving (I). Formation of $UO_2(H_2AsO_4)_2$ was not detected. Replacement of H_3AsO_4 by arsenates of Na, K, NH_4, Ca, or Cu^{II} gives the compounds $UO_2M^IAsO_4$ or $M^{III}(UO_2AsO_4)_2$, compounds corresponding with (II) not being formed. All the above compounds are insol. in H_2O except (II); they are sol. in $UO_2(OAc)_2$ forming complexes which are decomposed on dilution. A. J. E. W.

Fluorine at low temperatures. IX. Reaction between solid fluorine and liquid hydrogen. S. AOYAMA and E. KANDA (Bull. Chem. Soc. Japan, 1937, **12**, 521—524; cf. A., 1938, I, 130).—A glass bulb with capillary, holding solid F_2, is broken in liquid H_2. Action, usually explosive, increases with capillary internal diameter, and is not due to org. impurity (cf. A., 1933, 909). No explosion occurs with fine capillaries, nor with the gases mixed at room temp. in old glass vessels even under irradiation. The inhibition at low temp. of the action of a negative catalyst (SiF_4) is suggested. I. McA.

Action of the oxides of nitrogen on potassium iodide. M. DODE (Ann. Chim., 1938, [xi], **9**, 88—138).—The action of N_2O_4, alone and in presence of O_2, on both aq. and solid KI has been investigated, and the findings of earlier workers (A., 1914, ii, 287; 1929, 524) are criticised. A method for the determination of I, NO_2', NO_3', and IO_3' when present simultaneously in solution together with excess of KI has been worked out. The amounts of IO_3' found were never > the experimental error, and it could not be detected by qual. tests. The results indicate that N_2O_4 reacts with aq. KI in absence of O_2 in accordance with $N_2O_4 + 2KI = 2KNO_2 + 2I$ (1) and $2N_2O_4 + 2KI = 2KNO_3 + 2I + 2NO$ (2). The proportions of N_2O_4 which react in these two ways are determined by [KI] and temp., but are independent of the pressure, and no influence of light or of the walls of the vessels could be detected. Fall in temp. favours equation (1), as does increasing [KI] up to about 40%, when the proportion of KNO_3 formed becomes approx. const. In presence of O_2 the NO formed regenerates N_2O_4 and the total reaction is then represented by (1) together with $N_2O_4 + O_2 + 2KI = 2KNO_3 + 2I$ (3). It follows that in presence of O_2 there is always an exact equivalence $NO_2 \equiv I$. In practice a slight defect of I is found due to the liberation of traces of N_2 but this is never >0·5%. The interaction of N_2O_4 and solid KI is considered thermodynamically, with the assumption that solid solutions of KNO_2 in KNO_3 may be regarded as

ideal, and it is concluded that both reactions (1) and (2) should take place. Experimentally it is found that there is always a loss of N (approx. 3%) as N_2 and that at room temp. only 2% of KNO_2 is formed even in presence of excess of NO. True equilibrium is therefore not attained under these conditions. With rising temp. the % of KNO_2 increases to a max. at approx. 200°, and then corresponds more nearly with the theory. No iodate is ever formed. A study of the equilibrium $4KNO_2 + I_2 \rightleftarrows 2KNO_3 + 2NO + 2KI$ at 300° and at 350° gave results in qual. agreement with the thermodynamical predictions.

F. J. G.

Bromination of the different varieties of magnetite. R. S. HILPERT, A. HOFFMANN, and R. SCHACHT (Ber., 1938, **71**, [*B*], 82—87).—Magnetite (I), which has been obtained by reduction of strongly heated Fe_2O_3, is transformed by Br into $FeBr_3$ and Fe_2O_3. Specimens in the prep. of which a high temp. has been avoided add Br at about 230° giving the *substance* (II), $(Fe_3O_4)_3Br_2$. This is slowly decomposed by moist air or H_2O, more rapidly by NaOH or Na_2CO_3, with formation of γ-Fe_2O_3, whereas α-Fe_2O_3 arises from the chloride under similar conditions. (II) very rapidly yields $FeBr_3$ to Et_2O, but the change soon decelerates and finally γ-Fe_2O_3 remains. Presumably an additive compound of (I) and Et_2O is formed initially and then suffers rupture. The presence of free $FeBr_3$ in the adduct is negatived by the Röntgen diagram. Treatment of (I) with liquid Br at 280—250° gives the *product* Fe_3O_4Br, which is slightly less ferromagnetic than the initial material. Its Röntgen diagram shows a pronounced mixed lattice of α-Fe_2O_3 and spinel. Since the presence in it of notable amounts of $FeBr_3$ is excluded by its chemical behaviour, it probably contains FeOBr. This view is strengthened by the pronounced presence of lines closely resembling those of FeOCl in the Röntgen diagram of a product obtained from Fe, Fe_2O_3, and Br in a sealed tube. Use of a large excess of Br gives $FeBr_3$ and Fe_2O_3 which is not quite identical with the initial oxide. Chemical evidence points to the absence of FeOBr from completely brominated (I). Bromination of (I) occurs only at 240—300°. At 400° liquid Br and (I) give a completely non-magnetic Fe_2O_3 and $FeBr_3$. γ-Fe_2O_3 is converted by Br at 400° in a sealed tube into α-Fe_2O_3. Br vapour at atm. pressure and Cl_2 at 400° do not cause this change. H. W.

[Röntgenographically amorphous ferric oxide hydrate which does not combine with silver and has little activity.] R. FRICKE (Ber., 1938, **71**, [*B*], 128—130).—Repetition of the work of Krause (A., 1937, I, 577) shows that his Fe^{III} oxide hydrate when prepared in glass vessels contains much more SiO_2 than suspected previously. When made in vessels of Ag or Au–Pt the product contains much less SiO_2; it is then well-crystallised α-Fe_2O_3, but its activity towards H_2O_2 is < that of the siliceous, röntgenographically amorphous product. H. W.

Alkali compounds of ferric anhydride. III. Basicity and chemical properties of the ferrates. A. DEL BOCA (Anal. farm. bioquím., 1935, **6**, 65—69.)—Impure K perferrate, K_2FeO_4, was prepared by passing Cl_2 into conc. aq. KOH containing $Fe(OH)_3$. Attempts to reduce it to ferrate, and to prepare insol. ferrates of various metals, failed. CH. ABS. (*e*)

Cobalt hydroxides. C. DUVAL (Compt. rend., 1937, **205**, 665—668).—The action of aq. KOH on an aq. solution of a Co^{II} salt gives six substances, designated α, β, γ, δ, ε, and ζ. α (green), formed with excess of KOH in presence of air, is $K_3[Co(OH)_6]$; $Li_3[Co(OH)_6]$ is similarly obtained. β (brown) is $Co(OH)_3$, stable in presence of traces of KOH and O_2; excess of KOH converts it partly into α. It is obtained from a cobaltiammine salt, or by oxidising $Co(HCO_3)_2$ with H_2O_2. γ (ultramarine) is obtained by using excess of KOH at 60° in a current of N_2, in the dark, and is $K[Co(OH)_3(H_2O)_3]$; the *Li* salt resembles $Li[CoCl_3(H_2O)_3]$. δ (violet) is a mixture of γ and ε, formed by hydrolysis of γ or the action of a little KOH on ε or ζ. ε (deep rose) is obtained in the cold in a N_2 stream using a dil. solution and excess of Co^{II} salt; it is $[Co(H_2O)_6](OH)_2$. ζ (pale rose) is $Co(OH)_2$, obtained by dehydration of other forms.

A. J. E. W.

Action of oxalic acid on a cobaltic chloropentammine. (MLLE.) Y. WORMSER (Compt. rend., 1938, **206**, 109—111).—In presence of solutions containing 5—7% of $H_2C_2O_4$ solid $[Co(NH_3)_5Cl]C_2O_4$ is converted immediately into $[Co(NH_3)_5Cl]C_2O_4,2H_2C_2O_4,H_2O$. At the end of some months in contact with the mother-liquor the latter becomes $[Co(NH_3)_5C_2O_4]_2C_2O_4,4H_2C_2O_4$ and the violet liquid becomes reddish orange owing to the reactions $[Co(NH_3)_5Cl]^{\cdot\cdot} + C_2O_4'' = [Co(NH_3)_5C_2O_4]^{\cdot} + Cl'$; $[Co(NH_3)_5Cl]^{\cdot\cdot} + H_2O = [Co(NH_3)_5H_2O]^{\cdot\cdot\cdot} + Cl'$, which have been studied by means of absorption spectra at room temp. In a 0·01N solution of chloro-oxalate in 5% $H_2C_2O_4$ the concn. of the former decreases to 0 at the end of 1 month. The concn. of roseo-salt increases rapidly to a max. and then decreases to a limiting val. of 35%. The proportion of oxalato-salt increases to an equilibrium val. in 40 days. With 2% $H_2C_2O_4$ the proportion of roseo- is >, and of oxalato-salt <, before. It follows that whereas the solid chloro-oxalate is completely converted into oxalato-salt by $H_2C_2O_4$ the solution gives an equilibrium between roseo- and oxalato-salts. R. S. B.

Modifications of cobalt quinaldinate.—See A., II, 111.

Higher oxides of nickel (NiO_2). J. H. KŘEPELKA and M. BLABOLIL (Coll. Czech. Chem. Comm., 1937, **9**, 497—520).—Ni as the sulphate or chloride has been freed from Fe and Co (Vogel's test) by oxidation of the aq. solution with Br and pptn. with KOH. NiO_2 could not be obtained pure by the method of Bellucci and Clavari (A., 1905, ii, 823): the active O in the samples obtained was $\geq$78% of that required for NiO_2. Ni peroxide with the high content (98% of the theoretical) of active O claimed by Pellini and Meneghini (A., 1909, ii, 50) could not be prepared. Samples rich in O are very unstable and lose O_2 continuously. They are most stable at a composition approximating to $NiO_2,4NiO,nH_2O$. Curves showing the decomp. in air and in a desiccator are reproduced. Preps. with

high O content are hydrolysed with effervescence in contact with H_2O; those low in active O are unattacked at room temp. Debye-Scherrer photographs show that the freshly-prepared peroxide is mainly amorphous and gives only weak lines of cryst. NiO, and that it decomposes at temp. >220° to form a product showing the lines of NiO. L. S. T.

Compounds of bivalent platinum with α-alanine.—See A., II, 88.

Adsorption indicators. M. A. JOUNIAUX (Ann. Chim. Analyt., 1938, [iii], **20**, 5—8).—Applications of these indicators to volumetric processes are reviewed and the mechanism of their action is discussed. L. S. T.

Methods of determining deuterium. P. HARTECK (Z. Elektrochem., 1938, **44**, 3—6).—The relative sensitivities of the ρ (pyknometer and float), v.p., and interferometer methods of determining D_2O in H_2O, and the thermal conductivity method of determining D_2 and HD in H_2 for various quantities of material are discussed. J. W. S.

Azeotropic determination of water content of liquids.—See B., 1938, 115.

Potentiometric determination of chloride–bromide mixtures. H. SCHÜTZA (Angew. Chem., 1938, **51**, 55—56).—The method described is suitable for 1 : 1 to 1 : 15 Cl′–Br′ mixtures. L. S. T.

Application of electrometric iodometry to the analysis of iodine-containing medicaments.—See B., 1938, 224.

Application of salts of complex cations to microscopic detection of anions. II. 1 : 6-Dinitrotetramminocobaltic chloride (croceocobaltic chloride). L. K. YANOWSKI and W. H. HYNES (Mikrochem., 1937, **23**, 143—146).—Ppts. of characteristic habit are given by the HF_2', CrO_4'', Cr_2O_7'', VO_4''', C_2O_4'', and SO_3'' anions with 1 : 6-$[Co(NH_3)_4(NO_2)_2]Cl$. J. S. A.

Micro-determination of oxygen, alkalinity, and chloride in water.—See B., 1938, 233.

Determination of sulphur in metals.—See B., 1938, 173.

Determination of sulphur in pyrites and burnt pyrites.—See B., 1938, 161.

Volumetric determination of sulphuric acid in water.—See B., 1938, 159.

Microchemical contributions. L. ROSENTHALER (Mikrochem., 1937, **23**, 194—197).—N_3' gives characteristic ppts. with $Ag^{\cdot}$ from NH_3 solution, $HgNO_3$, $Pb(NO_3)_2$ in presence of HNO_3, and Tl_2SO_4. $Fe^{\cdot\cdot\cdot}$ may be detected by the catalytic acceleration of the oxidation of NH_2Ph with 1% aq. $KClO_3$ + dil. HNO_3, which produces a violet coloration; limit, 0·003 mg. of Fe. 0·001 mg. of Sb may be detected by the red ppt. given by SbH_3 (generated by reduction with Zn + HCl) with a solution of rhodamine + $HgCl_2$. H_3BO_3 gives a very sensitive red fluorescence with rufianic acid. VO_4''' gives a highly sensitive blue coloration with o-$C_6H_4(OH)_2$, and less sensitive colour reactions with o- and p-$C_6H_4(NH_2)_2$ and 1 : 2 : 5-$C_6H_3Me(NH_2)_2$. AcOH may be detected by conversion into o-$NO_2{\cdot}C_6H_4{\cdot}CHO$ (cf. A., 1935, 877), which is identified as its p-nitrophenylhydrazone. J. S. A.

Mutual reactions of phosphates and soils. IV. Volumetric determination of phosphoric acid. J. CLARENS and H. MARGULIS (Bull. Soc. chim., 1937, [v], **4**, 2081—2085).—PO_4''' is determined by titrating $CaH_2(PO_4)_2$ with aq. $Ca(OH)_2$ to $3Ca_3(PO_4)_2{,}Ca(OH)_2$, using phenolphthalein. Precautions, rendered necessary by the slight hydrolysis of $3Ca_3(PO_4)_2{,}Ca(OH)_2$, are described. E. S. H.

Co-precipitation of ammonium silicomolybdate and ammonium phosphomolybdate. Volumetric determination of phosphorus. N. BIRNBAUM and G. H. WALDEN, jun. (J. Amer. Chem. Soc., 1938, **60**, 66—70).—The ratio Mo : P in NH_4 phosphomolybdate, pptd. by alkaline NH_4 molybdate which has been stored in glass, increases with the age of the reagent. The effect is due to the presence of SiO_2; in absence of SiO_2, ppts. of theoretical composition can be prepared. Procedure for determining P in the ppt. is described; by modified procedure, P can be determined in presence of Fe. E. S. H.

Determination of total phosphoric acid in crude phosphates.—See B., 1938, 159.

Determination of phosphoric acid in textile fibres.—See B., 1938, 144.

[Microchemical analysis of] Czechoslovak meteoric stones.—See A., I, 164.

Organic precipitants for potassium. I. 2-Chloro-3-nitrotoluene-5-sulphonic acid and related compounds. V. H. DERMER and O. C. DERMER (J. Amer. Chem. Soc., 1938, **60**, 1—3).—The solubilities at 30° of the K and Na salts of 2-fluoro-, 2-chloro-, 2-bromo-, 2-iodo-, 2-fluoro-3-nitro-, 2-chloro-3-nitro-, 2-bromo-3-nitro-toluene-5-sulphonic acids, and 2-fluoro-, 2-chloro-, and 2-bromo-nitrobenzene-5-sulphonic acids have been determined. Only 2-bromo-3-nitrotoluene-5-sulphonic acid is as suitable as the Cl-compound for the determination of K. E. S. H.

Crystallisations on glass slides produced from solution by evaporation of the solvent. J. SEIGLE (Chim. et Ind., 1937, **38**, 1050—1058).—The different aspects presented by the crystallisation under varying conditions of the following substances on glass slides are described and discussed: aq. NaCl, aq. KCl, aq. NH_4Cl, alum, S from C_6H_6 solution, I from Et_2O, aq. KNO_3, $KClO_3$, $KMnO_4$, $K_2Cr_2O_7$, $Na_2S_2O_3$, $MnSO_4$, $CuSO_4$, $CuCl_2$ from EtOH, aq. $CO(NH_2)_2$, sucrose, and $C_{10}H_8$, and picric acid from EtOH. Certain generalisations are discussed. L. S. T.

Microchemical mineral analysis. VI. A. MARTINI (Mikrochem., 1937, **23**, 159—164).—Rb and Cs may be detected in presence of other alkalis and each other by the characteristic habit of the ppt. given with NaBr + $RhCl_3$. $NH_4^{\cdot}$ gives characteristic cryst. ppt. with picrolonic acid, as does Cu with $(CH_2{\cdot}CO_2H)_2$ + aq. NH_3. J. S. A.

Mercurimetric micro-determination of silver. J. TRTÍLEK (Mikrochem., 1937, **23**, 190—194).—Ag

is pptd. with an excess of standard KCl, which is titrated back with 0·01N-$Hg(NO_3)_2$ using diphenylcarbazone as indicator in presence of the pptd. AgCl. J. S. A.

Standardising silver nitrate solution. R. D'Orazio (Ind. Eng. Chem. [Anal.], 1938, **10**, 23).—Aq. HCl is neutralised to phenolphthalein with standard alkali and then the chloride solution is titrated with aq. $AgNO_3$. The method agrees with the CNS′ volumetric and the AgCl gravimetric methods, and is much quicker. L. S. T.

Polarographic detection of zinc and nickel present together. P. N. Pavlov and G. S. Pavlenko (J. Gen. Chem. Russ., 1937, **7**, 2259—2263).—The deposition potentials of Zn and Ni from solutions of their simple salts are so close to each other (1·06 and 1·002 v., respectively) as to render the polarographic detection of one in presence of the other impossible. In presence of aq. NH_3 and gelatin the potentials become 0·96 v. for Ni and 1·36 v. for Zn, and the metals can then be distinguished. R. T.

Determination of zinc in brasses.—See B., 1938, 174.

Polarographic determination of lead and arsenic in reagent phosphoric acid. T. A. Kriukova (Zavod. Lab., 1937, **6**, 1385—1393).—The polarographic determination of traces (>0·00001%) of Pb and As in H_3PO_4 is performed most conveniently in the presence of conc. H_3PO_4. Methods of determining Pb and As separately or in the presence of each other are described; in the latter case HCl must be added. Since $As^{\cdots\cdots}$ is not reducible in H_3PO_4, but can be converted into $As^{\cdots}$ by boiling with N_2H_4, both ions can be determined. The effect of admixtures is discussed and limits are given for permissible contents of $Ca^{\cdot\cdot}$, $Fe^{\cdots}$, $Al^{\cdots}$, F', SO_3'', $K^{\cdot}$, $Na^{\cdot}$, and SiO_2. The results are accurate to within ±3% for Pb and ±5% for As. Diagrams and tables are given. D. G.

Detection of lead [in petroleum containing lead ethyl].—See B., 1938, 225.

Dithizone as an aid in emission spectral analysis. F. Rohner (Helv. Chim. Acta, 1937, **21**, 23—32).—The material is extracted from aq. solution by dithizone in CCl_4, a known quantity of a comparison metal ion added, and the combined solution of dithizonates is fed into a condensed spark and its spectrum observed. A method for continuous feed of the solution to the spark is described. The method can be applied to determination of $Cu^{\cdot\cdot}$, $Ag^{\cdot}$, $Au^{\cdots}$, $Zn^{\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Hg^{\cdot\cdot}$, $Tl^{\cdot}$, $Sn^{\cdot\cdot}$, $Pb^{\cdot\cdot}$, $Bi^{\cdots}$, $Mn^{\cdot\cdot}$, $Co^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, and $Pd^{\cdot\cdot}$. J. W. S.

[Spectrographic determination of aluminium, magnesium, copper, and silicon.]—See B., 1938, 173.

Quantitative spectrum analysis of solutions. A. K. Rusanov, S. I. Kunina, and K. N. Vasiliev (Zavod. Lab., 1937, **6**, 1420—1423).—A quant. photometric method of determining Ga in solutions is described. The range investigated covers Ga contents varying between 0·00620 and 0·400%. The spectroscopic experiments were carried out in an C_2H_2 flame in presence of K and Rb, respectively, the following pairs of lines being investigated: (*a*) Ga 4033·01 A.–K 4044·16 and 4047·22 A., (*b*) Ga 4172·05 A.–Rb 4201·81 A., and (*c*) Ga 4172·05 A.–Rb 4215·58 A. The average error is ±5%. The min. Ga content determinable is 0·0075%. D. G.

Direct photoelectric determination of manganese and chromium in steels.—See B., 1938, 173.

Determination of iron with thioglycollic acid. H. W. Swank and M. G. Mellon (Ind. Eng. Chem. [Anal.], 1938, **10**, 7—9).—A spectrophotometric examination of the method shows that (i) Beer's law is closely followed, (ii) the intensity of the colour is independent of the form in which the reagent is added and its concn. provided an excess is present, (iii) the $[NH_3]$ can be varied over a wide range without effect, and (iv) the colour is relatively stable. The method is practically free from interference by PO_4''', P_2O_7'''', F', tartrate, citrate, and oxalate ions. The limiting amounts of interfering ions have been determined for a vol. of 100 ml. containing 10 mg. of Fe. The comparative freedom from interference by many ions, and the reproducibility and sensitivity of the reaction, make the method superior to various other colorimetric procedures for Fe. L. S. T.

Separation of iron, aluminium, chromium, uranium, zirconium, and titanium from manganese, cobalt, nickel, calcium, strontium, barium, magnesium, and the alkalis by means of pyridine. E. A. Ostroumov (Ann. Chim. Analyt., 1938, [iii], **20**, 9—12).—Former work (A., 1936, 1222, 1353; 1937, I, 329) is summarised, and the practical procedure to be followed is given. L. S. T.

Use of selenious acid for gravimetric determination of chromium. A. Jílek and J. Kot'a (Chem. Listy, 1938, **32**, 30—33).—15 c.c. of 33·3% NH_4NO_3, 10 c.c. of 10% NH_4OAc, and 20 c.c. of 10% SeO_2 are added to 50 c.c. of the solution, containing >0·1 g. of Cr^{VI}, and the solution is neutralised with aq. NH_3. The ppt. of $Cr(OH)_3$ is collected after 12 hr., washed, and ignited at 1030°. R. T.

Determination of molybdenum with silver reductor. N. Birnbaum and G. H. Walden, jun. (J. Amer. Chem. Soc., 1938, **60**, 64—66).—Quant. reduction to Mo^{V} occurs in 2M-HCl solutions at 60—80°. The reduced solution may be titrated with $Ce(SO_4)_2$, using the *o*-phenanthroline Fe^{II} complex indicator. Other reducible substances interfere with the determination. E. S. H.

Spectroanalytical determination of molybdenum and vanadium in the mine burrows of Richelsdorf. E. Preuss (Z. angew. Min., 1937, **1**, 93—96).—The method used for determining the Mo and V contents of samples from the slate burrows of the old Cu mine at Richelsdorf is described. The Mo and V contents are ~0·02% and 0·1%, respectively, and the accuracy of the method varies from 14 to 3·5%, according to conditions of comparison. L. S. T.

Determination of antimony in the presence of [quinquevalent] arsenic using tin amalgam.

I. V. TANANAEV and E. G. DAVITASCHVILI (Zavod. Lab., 1937, **6**, 1382—1385).—Sn amalgams reduce Sb^{III}, Sb^{V}, and As^{III}, but not As^{V}, to Sb and As, respectively. It is therefore possible to determine Sb in the presence of As^{V}. The method is accurate and the time required for analysis is only 5—10 min. D. G.

Spectrographic determination of niobium and tantalum. R. BRECKPOT and J. CREFFIER (Ann. Soc. Sci. Bruxelles, 1937, **57**, 290—295).—Mixtures of Nb_2O_5 and Ta_2O_5 (0—100% Nb_2O_5) were investigated spectrographically. Data for the separation and intensity of homologous lines at various concns. as a basis for determination are tabulated. N. M. B.

Spectrographic determination of gold in alluvial deposits. G. CLAUS, F. HEGEMANN, and F. ROST (Z. angew. Min., 1937, **1**, 60—82).—The chemical processes involved in the Br extraction of an alluvial sample have been investigated in detail. The physical and chemical relationships involved in the treatment of arc-light C with Au solutions and the burning of this C in the electric arc have also been studied. The method based on these results consists of extracting the Au from 1000 g. of the alluvial material by treatment with Br and Et_2O, and dilution with H_2O. 0·1—0·5 c.c. of the Br extract is dropped directly on to the C cathode, or in order to obtain increased sensitivity, 25 c.c. are evaporated and fused with $Pb(OAc)_2$ and a carbonate–borax–SiO_2 flux and the Pb regulus dissolved in HNO_3 and Br–H_2O. The solution is then dropped on to the C electrode. The sensitivities are 0·2 g. and 0·4 mg. per m. ton, respectively. L. S. T.

Determination of palladium in palladium–silver alloys.—See B., 1938, 175.

Flexible gas thermoregulator. A. J. BAILEY (Science, 1937, **86**, 525—526).—In the apparatus described the expansion and contraction of air operates a Hg valve controlling the flow of gas. The regulator can be employed with precision over a wide range of temp. L. S. T.

Measurement of high surface temperatures.—See B., 1938, 113.

Thermometer with colourless indicating liquid.—See B., 1938, 113.

Gas furnace for heating tubes to a high temperature. A SLOOFF (Chem. Weekblad, 1938, **35**, 104).—A small tube furnace (11 × 12·5 × 5 cm.), constructed from two diatomite stone blocks and heated with a Meker burner, is described. A temp. of >1300° can be obtained, but 1200—1300° is recommended for heating a SiO_2 tube (20 mm. diameter). S. C.

Infra-red spectrograph with a new type of recorder for heat radiation. E. LEHRER (Z. tech. Physik, 1937, **18**, 393—396).—The method uses a bolometer to detect the radiation, together with an amplifier. An inker is used for the recording. The apparatus is particularly useful in industrial laboratories for qual. and quant. analysis. A. J. M.

Photography in the infra-red. M. CZERNY and P. MOLLET (Z. Physik, 1938, **108**, 85—100, and Physikal. Z., 1937, **38**, 1008—1010).—A method for photographing infra-red spectra in the region 1—10 μ. is described. The spectrum is focussed on to a celluloid film 0·1 μ. thick which is backed with a coating of radiation-absorbing material. A thin layer of paraffin oil is then evaporated on to the face side of the film in vac. Incidence of infra-red radiation causes partial evaporation of the oil layer, giving rise to a visible image of the spectrum in interference colours; this may be photographed. H. C. G.

Practical spectrographic analysis. J. S. OWENS (Met. & Alloys, 1938, **9**, 15—19).—The following accessories are described: graphite electrodes purified by electrical heating at a high temp. in vac., an alignment pointer for the spectral source, an a.c. arc spectral source, and a graphical plate calculator for the conversion of microphotometer readings into % concns. The sensitivity, rapidity, and accuracy of spectrographic analysis have been increased by this special equipment and technique. P. G. McC.

Technique for making collodion filter for the $K\alpha$ chromium radiation. S. S. SIDHU (Indian J. Physics, 1937, **11**, 337—338).—To make collodion filters of NH_4VO_3 (25 g. in 40 c.c. of collodion), polished discs of Al are dipped into the solution, and the collodion layer, when dry, is peeled off, softened with EtOH, and dried at 80° under pressure. F. J. L.

***X*-Ray spectroscopy at temperatures of liquid hydrogen and helium.** A. GOETZ [with R. B. JAKOBS and O. B. JACKSON] (Physikal. Z., 1937, **38**, 998).—An *X*-ray spectrograph has been constructed in which the *X*-ray source and the ionisation chamber are at room temp. and the crystal holder can be cooled by adiabatic expansion of He. The crystal can be cooled continuously from room temp. to < the b.p. of He. The apparatus can be used for the determination of the variation of intensity of reflexions with temp., to test the Debye–Waller relationship, and to determine zero-point energy. A. J. M.

Simplifications and improvements in photographic spectrophotometry with an auxiliary source. G. BOLLA (Nuovo Cimento, 1937, **14**, 350—360).—The advantages of using a V-shaped spectrometer slit in spectrophotometric measurements are discussed, and a method of measuring the relative intensities of spectral lines based on the use of such a slit is described. O. J. W.

Method for the study of the hyperfine structure and width of absorption lines. M. DUFFIEUX and J. BOLLOT (Compt. rend., 1937, **205**, 1227—1229).—An apparatus of very high resolving power, consisting of a monochromator and two successive interferometer systems, is described. A. J. E. W.

Measurement of light from a tellurium vapour arc. J. W. MARDEN, N. C. BEESE, and G. MEISTER (J. Franklin Inst., 1938, **225**, 45—52).—A Te-vapour lamp fitted with pool type electrodes in a quartz container and giving a continuous spectrum over the visible range is described. The spectral distribution is practically the same as that of a black body at 6000° K. when operating at low wattage, but at

higher wattage the red predominates. The electrode losses are > in Hg- and Na-vapour arc lamps. F. J. L.

New objective method of heterochromic photometry. J. VOROBEITCHIK (Compt. rend., 1937, **205**, 1222—1224).—The reference standard is matched to the unknown source by mixing the radiations from two standard lamps at different colour-temp. A. J. E. W.

External lighting for reading Lovibond colours. P. THOMSON (Oil & Soap, 1938, **15**, 4—6).—Differences in Lovibond colour readings may be caused by variations in the intensity of the light used for the illumination of the room in which the instrument is situated, a high intensity leading consistently to higher red readings than a low level A testing booth, having dark grey walls and illuminated by a 15-watt daylight lamp in the ceiling, is recommended. E. L.

Simple direct-reading colorimeter. J. LEBOWICH, R. J. LEBOWICH, and M. HINBURG (J. Lab. Clin. Med., 1937, **23**, 284—292).—The design, operation, manipulation, and some of the uses of a simple, direct-reading photo-electric colorimeter are described. T. H. H.

Apparatus for colorimetry. III. S. SHINKAI (J. Soc. Chem. Ind. Japan, 1937, **40**, 407—408B).—An apparatus for colour matching is described and applied to the determination of Cu in alloys with Al and Zn. R. S. B.

Monochromator with double dispersion for the region 0·200 to 4 μ. C. LEISS (Z. Physik, 1937, **107**, 766—768).—A monochromator with one 30° glass prism through which incident light passes a second time after reflexion by a combination of slit and plane mirror is described. A modification of the instrument with a quartz optical system is suitable for the Schumann region. H. C. G.

Monochromator. Y. ÖHMAN (Nature, 1938, **141**, 157—158).—The instrument is built up of a no. of "Polaroid" films with intermediate quartz plates and serves to isolate a small region in a continuous spectrum. L. S. T.

Testing of diffraction gratings by knife-edge and by interferometer. H. G. GALE (Astrophys. J., 1937, **86**, 437—445).—Knife-edge and interference tests for an optical surface are compared; they are approx. equal in sensitiveness. L. S. T.

Physical and radiographic properties of metallic intensifying screens. H. E. SEEMANN (J. Appl. Physics, 1937, **8**, 836—845).—Screens of metals of high at. no. yield the greatest intensification of the latent image on *X*-ray photographic plates when the emulsion is placed in contact with the metal during the irradiation. Pb is the most convenient metal in use. The screen is more effective when between the *X*-ray source and the emulsion than when behind the emulsion. The action is due principally to electron emission and only slightly to characteristic and scattered *X*-rays. J. W. S.

Measurement of the dielectric constant of solid substances by means of ponderomotive forces. I. Quartz glass. D. DOBORZYNSKI (Bull. Acad. Polonaise, 1937, **A**, 320—334).—The theory of the method of determination of the dielectric const. of a solid elliptical body by measurement of the rotation in an alternating electric field is worked out and an apparatus and experimental procedure described. For quartz glass $\epsilon = 3{\cdot}92 \pm 0{\cdot}20$. F. J. L.

Multivibrator Geiger counter circuit. I. A. GETTING (Physical Rev., 1938, [ii], **53**, 103).—The circuit described employs a multivibrator so biased that it cannot oscillate; the length of the pulse is limited by the vac. tube circuit and not by the counter. Several advantages are enumerated. N. M. B.

Production, characteristics, and reliability of Geiger-Müller counters. O. S. DUFFENDACK, H. LIFSCHUTZ, and M. M. SLAWSKY (Physical Rev., 1937, [ii], **52**, 1231—1237).—A systematic investigation favours the use of pure H_2 and electrodes previously cleaned by sputtering in a glow discharge in H_2. The difficulty of long relaxation time is overcome by replacing the quenching resistance by a properly designed vac. tube circuit. Cu, Ni, and W, but not Al, are suitable for cathode cylinders. Tubes filled with A, O_2, or air gave many spurious counts. Extensive tests show that properly designed tubes and circuits give reliable quant. data. N. M. B.

Temperature compensation circuits for p_H and conductivity determinations etc. F. LIENEWEG (Z. tech. Physik, 1937, **18**, 382—387).—Theoretical. A. J. M.

Differential electro-titration. (MME.) R. DUVAL and C. DUVAL (Compt. rend., 1937, **205**, 1237—1238).—The two ratio-arms of a slide-wire bridge consist of conductivity cells containing the solution to be titrated; the reagent is added alternately to each cell. The end-point is deduced graphically, or by a sudden change in the direction of movement of the balance point on further addition of the reagent. A. J. E. W.

Apparatus for measurement of resistivity. G. BEAU (J. Pharm. Chim., 1938, [viii], **27**, 53—56).—Details are given of an improved circuit employing valve oscillators and a loud-speaker. F. J. G.

Measurement of resistivity of mineral waters. (MME.) L. BLANQUET (J. Pharm. Chim., 1938, [viii], **27**, 49—53).—The measurements should be carried out at a fixed temp., and the duration of pumping and of subsequent exposure to air should be stated. F. J. G.

Continuous reading device for electrical conductivity. M. MATSUI and N. MORISIMA (J. Soc. Chem. Ind. Japan, 1937, **40**, 415—416B).—Apparatus is described. R. S. B.

Electron diffraction. C. S. BARRETT (Met. Prog., 1937, **32**, 655—660).—Practical applications, *e.g.*, the study of surface chemical reactions, are discussed. R. B. C.

Selenium photo-elements.—See B., 1938, 180.

Absorption cell for photo-electric microcolorimeter. K. A. EVELYN and J. G. GIBSON, 2nd. (J. Biol. Chem., 1938, **122**, 391—394; cf. A., 1937, 1, 151).—A new plunger type of cell is described. Determin-

ations can be made on 1·1, 0·6, and 0·15 c.c., the corresponding thicknesses of the absorption layers being 10, 5, and 1 mm., respectively. J. N. A.

Physical properties of photo-electric cells. O. VIKTORIN (Chem. Listy, 1938, **32**, 24—27).—The relations between the sensitivity of a photo-electric cell and the resistance and potential are studied. The use of the cells for studying ultra-violet radiation incidental to chemical reactions is illustrated. R. T.

Neutron tube without pumping apparatus. F. M. PENNING and J. H. A. MOUBIS (Physica, 1937, **4**, 1190—1197).—A discharge tube for the excitation of neutrons by bombarding a Zr–D target with D ions is described. The source of the ions is a glow discharge, maintained by means of an electric field so that no pumping is required between it and the part of the tube where the ions are accelerated. F. J. L.

Suitability of the air-equivalent ionisation chamber for the determination of extremely hard radiation. R. SCHULZE (Z. tech. Physik, 1937, **18**, 480).—Experiments have been carried out to show the equivalence of the ionisation current in air, and in an air-equiv. ionisation chamber. A. J. M.

Multiple pipetting machine. W. N. PLASTRIDGE and L. F. WILLIAMS (J. Lab. Clin. Med., 1937, **23**, 318—320).—A mechanical pipetting machine capable of filling 140 tubes per min. is described. T. H. H.

Drying and weighing hygroscopic substances in micro-analysis. D. F. HAYMAN (Ind. Eng. Chem. [Anal.], 1938, **10**, 55—56).—Methods are described, and the necessity of determining the relative hygroscopicity of every sample analysed is emphasised. A micro-balance capable of giving readings const. to ± 2 μg. over a period of several min. is essential. A new type of "pig," and a special technique by which sample and "pig" can be weighed to ± 2 μg., are described. A revised method for handling substances out of contact with damp air is given. Used with a Cu boat, the special "pig" is of service in the micro-Dumas method for N. L. S. T.

Pressure multiplier for the determination of small velocities of streaming. P. GMELIN and R. RIEDMILLER (Z. tech. Physik, 1937, **18**, 375—377).—A more sensitive apparatus than that formerly in use for determining the velocity of flow of gases, particularly in wide tubes, is described. A. J. M.

Bomb for use in hydrothermal experimentation. G. W. MOREY and E. INGERSON (Amer. Min., 1937, **22**, 1121—1122). L. S. T.

Sound-films as diffraction gratings for the visual Fourier analysis of sound-waves. D. BROWN (Nature, 1937, **140**, 1099). L. S. T.

Applicability of the Emich filter stick to "tenth-milligram" and "gamma" scale working. G. GORBACH and M. KOSTIČ (Mikrochem., 1937, **23**, 176—190).—The necessary modifications in apparatus and technique, and the adaptation of pptn. analyses on the "tenth-mg." scale to biological problems, are outlined. J. S. A.

Apparatus for drying small amounts of material. F. FUHRMANN (Mikrochem., 1937, **23**, 167—173).—Blocks for drying, heating, and evaporation of liquids are described. J. S. A.

Fractionation receiver with cooling sleeve. P. SUTTER (Helv. Chim. Acta, 1938, **21**, 94—95).—A modified form of Anschutz–Thiele apparatus, suitable for fractional distillation under very low pressure with cooled brine passing through the outer jacket, is described. J. W. S.

Designs for laboratory fractionating columns. J. H. SIMONS (Ind. Eng. Chem. [Anal.], 1938, **10**, 29—31).—A design for the head of a column in which the liquid is partitioned for withdrawal by means of a ground-glass plug, and one for partitioning the hot vapour between two condensers prior to withdrawal and to return to the reflux columns, for distillations between room temp. and −5°, for pressures >1 atm., and for low-temp. are described. All columns are constructed from stock sizes of Pyrex glass. L. S. T.

Fractionating device for vacuum distillations. E. NOONAN (Ind. Eng. Chem. [Anal.], 1938, **10**, 34).—A device for collecting and removing fractions of distillate without interrupting the distillation under reduced pressure is described. L. S. T.

Devices for extraction by immiscible liquids. H. J. WOLLNER and J. R. MATCHETT (Ind. Eng. Chem. [Anal.], 1938, **10**, 31—32).—Two designs of apparatus for extracting solute-bearing liquids of $d >$ or $<$ that of the extracting liquid are described. L. S. T.

Chemical extraction with a simple automatic shaker. T. NEUSTAEDTER and R. HOLTZ (J. Lab. Clin. Med., 1937, **23**, 313—314). T. H. H.

Capillary-type viscosimeter. P. E. RAASCHOU (Ind. Eng. Chem. [Anal.], 1938, **10**, 35—39).—The apparatus described measures η over the ranges 1·5 to 100 or 100 to 5000 centistokes according to the way in which it is used. Temp. is measured in the liquid under test and η can be determined over a wide range of temp. Surface tension can also be determined with this instrument. L. S. T.

Neo-silvol as the colloidal solution in demonstrations of diffusion. S. L. MEYER (Science, 1937, **86**, 526).—A 5% aq. solution of neo-silvol (18 to 22% colloidal AgI in a sol. gelatin base) gives results better than those obtained with the usual colloids for demonstrating the relative rates of diffusion of true and colloidal solutions through agar or gelatin. L. S. T.

Stirring in the laboratory. H. J. PRINS (Chem. Weekblad, 1938, **35**, 34).—In order to increase turbulence a high-speed stirrer of the glass cross or propeller type is surrounded by a stationary perforated glass bell such as is used as the rotor in the Witt type of stirrer. S. C.

Reaction vessels for pressure experiments. A. V. GROSSE (J. Amer. Chem. Soc., 1938, **60**, 212—214).—The vessels, made of glass, fused quartz, or metal, are provided with a capillary to minimise the diffusion of gases and vapours, and fitted inside high-pressure autoclaves. E. S. H.

Fluorine generator. A. L. HENNE (J. Amer. Chem. Soc., 1938, **60**, 96—97).—Cu apparatus for the continuous electrolysis of KF,3HF is described. E. S. H.

Method of preparing thin films. E. L. KALLANDER (Ind. Eng. Chem. [Anal.], 1938, **10**, 40).—A modification of Sager's method (B., 1937, 628), applicable to the spreading of aq. or non-aq. dispersions on sheet materials and giving films of reproducible thickness free from strains, is described. L. S. T.

Atomic transmutation with positive rays as a lecture experiment. R. DÖPEL (Physikal. Z., 1937, **38**, 979—981).—Apparatus, by means of which the occurrence of the reactions $^2_1D + ^2_1D = ^3_1H + ^1_1H$ and $^2_1D + ^2_1D = ^3_2He + ^1_0n$, can be demonstrated as a lecture experiment, is described. A. J. M.

Historical studies on the phlogiston theory. II. Negative weight of phlogiston. J. R. PARTINGTON and D. MCKIE (Ann. Sci., 1938, **3**, 1—58).

Radiant heat spectrum from Herschel to Melloni. I. Work of Herschel and his contemporaries. E. S. CORNELL (Ann. Sci., 1938, **3**, 119—137).

Ruska's work on Arabic alchemy. R. HOOYKAAS (Chem. Weekblad, 1938, **35**, 149—153).

Le Chatelier memorial lecture. C. H. DESCH (J.C.S., 1938, 139—150).

Geochemistry.

Physical and chemical characteristics of Cultus Lake, British Columbia. W. E. RICKER (J. Biol. Board Canada, 1937, **3**, 363—401).—Data concerning temp., p_H, and the O_2, HCO_3', NO_3', PO_4''', and SiO_2 contents of lake-H_2O are recorded and discussed. L. S. T.

Mineral water of the Poljana baths, at Svalava (Sub-Carpathian Ruthenia). J. NEMEJC (Chem. Listy, 1938, **32**, 22—23).—Analytical data are given. R. T.

Limestone caves and hot springs of the Songwe River, Mbeya area, and the associated guano deposits. E. O. TEALE and F. OATES (J. East Africa and Uganda Nat. Hist. Soc., 1934, **12**, 130—137).—Analytical data are given. CH. ABS. (*e*)

Relation between the viscosity and the Loewinson-Lessing acidity coefficient for molten rocks. M. P. VOLAROVITSCH and L. I. KORTSCHEMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 417—422; cf. A., 1936, 450).—From measurements on 33 different rocks the empirical relation $\log \eta = -23{\cdot}3/(\alpha + 1{\cdot}1) + 10{\cdot}5 + n$ was established (η = viscosity; α = acidity coeff.). The experimental vals. of η for a few mono-mineral rocks such as orthoclase, and also those for glasses, are not consistent with the above relation, which, however, gives a smoother curve than the plot of η against SiO_2 content. R. C. M.

Velocity of sound in rocks and glasses as a function of temperature. J. M. IDE (J. Geol., 1937, **45**, 689—716).—The velocity of sound in Pyrex and in SiO_2 rises with an increase in temp. Pyrex supports vibrations up to 700° and SiO_2 up to approx. 1000°. Rock samples show a decrease in velocity with a rise in temp., with only partial reversibility on cooling. Data for steel, Cu, elinvar, limestone, Pyrex, SiO_2, obsidian, soft glass, granite, norite, sandstone, diabase, and marble are recorded and their geophysical significance is discussed. L. S. T.

Western part of the Criffell-Dalbeattie igneous complex. M. MACGREGOR (Quart. J. Geol. Soc., 1937, **93**, 457—486).—Chemical analyses of the Plutonic rocks, the minor intrusive rocks, country-rocks, and marginal igneous rocks are recorded. L. S. T.

Organic matter in Arkansas bauxite. D. UTLEY (Ind. Eng. Chem., 1938, **30**, 35—39).—The org. matter (0·3—0·4%) is humic in nature (C 52—56%) and is derived from the overlying lignites. After extraction with alkali and pptn. with dil. H_2SO_4, the humic matter can be separated into fractions according to solubility in acid and EtOH or pptn. with Al_2O_3, and all appear to be oxidation products of humic acid. The compositions of the humic acids from the lignite and the bauxite are compared. The org. matter in the bauxite is best determined, after preliminary treatment with dil. H_2SO_4 in order to remove carbonates, by direct wet combustion. An arbitrary ratio of C to org. matter must be taken. J. A. S.

Viscosity of obsidianite and its relation to the genesis of pumice. M. P. VOLAROVITSCH and A. A. LEONTEEVA (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 423—425).—Measurements of η of 3 samples of obsidianite at 800—1200° gave a linear plot of $\log \eta$ against temp., lying considerably below the corresponding plot for quartz (due to the alkalis in the obsidianite). Between 1050° and 1170° all three specimens swelled up into spongy pumice-like structures. If an acid magma of the composition of obsidian is erupted below 1000°, it will solidify as a glass, whereas if the initial temp. is 1100—1200°, a pumice will result. R. C. M.

Unit cell and space-group of tourmaline. Inspective equi-inclination treatment of trigonal crystals. M. J. BUERGER and W. PARRISH (Amer. Min., 1937, **22**, 1139—1150).—The inspective equi-inclination treatment of hexagonal crystals in general is outlined. Tourmaline is based on a rhombohedral rather than on a hexagonal lattice. Tourmaline from the Etta Mine, S. Dakota, ω 1·658±0·002, and ϵ 1·633±0·002, has a 9·500 A., α 66° 05′, or referred to the simplest hexagonal cell A 15·928, C 7·151 A. The space-group is C^6_{3v}, $R3m$. On the rhombohedral lattice there is one formula wt. $(Na,Ca)R_3(AlFe)_6B_3Si_6O_{24}(O,OH,F)_4$ per cell, and three on the hexagonal lattice. L. S. T.

Wisconsin lead-zinc district. C. H. BEHRE, jun., E. R. SCOTT, and A. F. BANFIELD (Econ. Geol., 1937, **32**, 783—809).—The ores are richer in pyrite than was formerly recognised, and probably also in wurtzite, now largely converted into sphalerite. Rhythmic banding is common in ZnS deposition. Brittle dolomites are the most favoured host rocks, and the ores are mainly fracture fillings. The data favour the view that the ores are due to rising solutions probably of ultimate magmatic origin. L. S. T.

Origin of primary lead ores. A. HOLMES (Econ. Geol., 1937, **32**, 763—782).—Pb conc. in ore deposits is common Pb or ore-Pb with an at. wt. 207·21. The Pb dispersed through rocks in small amounts is rock-Pb, and consists partly of common Pb originally present in the rock-material and partly of radiogenic Pb, which has been generated in the same material from the disintegration of U and Th during geological time; this is now estimated to be approx. 2×10^9 years. The available data for Pb, U, and Th in rocks show that the average at. wt. of granitic and basaltic rock-Pb should have progressively decreased during this time from 207·21 to 207·14, and 207·21 to 207·10, respectively. The at. wt., 207·05, of rock-Pb conc. in the sublimate mineral, cotunnite, from Vesuvius confirms the view that rock-Pb has an at. wt. $<$ that of common Pb. The at. wt. of ore-Pb, $207{\cdot}21 \pm 0{\cdot}01$, is independent of the geological age of the ore. Ore-Pb has not been derived from granitic or basaltic rocks or from the sediments formed from them, and it has no genetic connexion with acid or basic magmas. It must have ascended from depths below the sialic and basaltic layers of the lithosphere. L. S. T.

Pyrrhotite ruby silver occurrence in British Columbia. H. V. WARREN and K. DE P. WATSON (Econ. Geol., 1937, **32**, 826—831).—Ruby silver and pyrrhotite occur intimately associated at the Providence Mine, near Greenwood, B.C. Sphalerite, galena, chalcopyrite, tetrahedrite, quartz, and calcite are associated with these minerals. Chalcopyrite and ruby silver are closely related, and have partly replaced pyrrhotite, which is older. The ruby silver is probably hypogene in origin. L. S. T.

Ore deposits of the Sunlight mining region, Park County, Wyoming. W. H. PARSONS (Econ. Geol., 1937, **32**, 832—854).—Occurrence, mineralogy, paragenesis, and zoning are described. The deposits occur as narrow fissure veins in Tertiary volcanic breccias, and the mineralisation is typical of most epithermal deposits. The common ore minerals are pyrite, chalcopyrite, galena, and tetrahedrite, with some Au and Ag (assays given). The gangue is essentially carbonates and quartz. L. S. T.

Petrology, structure, and relation to tectonics of porphyry intrusions in the Beartooth mountains, Montana. J. T. ROUSE, H. H. HESS, F. FOOTE. J. S. VHAY, and K. P. WILSON (J. Geol., 1937, **45**, 717—740).—Five chemical analyses of the porphyries are included. L. S. T.

Meteorite from Yurtuk village, Dniepropetrovsk region. L. L. IVANOV (Compt. rend. Acad. Sci., U.R.S.S., 1937, **17**, 371—373).—The meteorite, *d* 3·299 (chemical analysis given), contained a plagioclase, pyroxene, olivine, troilite, chromite, and glass. Metallic Fe was absent. The meteorite can be assigned to the achondrite category. L. S. T.

Heavy mineral sands of the Baltic coast between Warnemünde and the Darss locality and their formation by surf. W. VON ENGELHARDT (Z. angew. Min., 1937, **1**, 30—59).—Mineral compositions of the quartz- and felspar-free fractions of 5 heavy mineral sands are recorded. The mechanism of their formation is discussed. L. S. T.

Rôle of foraminifera and of calcium carbonate in the fixation of certain mineral substances. L. CAYEUX (Compt. rend., 1938, **206**, 81—85).—The rôle of foraminifera in the fixation of glauconite, $Ca_3(PO_4)_2$, and pyrites is discussed, and is considered less important than substitution involving $CaCO_3$. R. S. B.

Cordierite. A. N. WINCHELL (Amer. Min., 1937, **22**, 1175—1179).—Diagrams showing variations in composition and physical properties, and relations between *d* and optical properties, are reproduced and discussed. L. S. T.

Metallographic study of minerals from Příbram, Czechoslovakia. J. SEKANINA (Bull. Soc. Franç. Min., 1937, **60**, 152—223).—Measurements of reflecting power, and the behaviour towards etching agents, of certain minerals, the effect of light on argyrite, polybasite, and stephanite, and the results of a detailed examination of polished sections of 43 minerals, are recorded. L. S. T.

Nature and origin of chert in the Lockport and Onondaga formations of Ontario. H. C. LAIRD (Trans. Roy. Canad. Inst., 1935, **20**, 231—304). CH. ABS. (*e*)

Genesis of minerals from soil colloids of the montmorillonite group. I. SEDLECKI (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 375—377).—Artificially-prepared Al silicate gel impregnated with $Mg^{\cdot\cdot}$ gives artificial montmorillonite which *X*-rays show to be in the amorphous condition. After keeping at room temp., the aged gel shows the presence of typical montmorillonite incompletely cryst. but containing extremely small crystallites. The heating curve is typical of that of natural montmorillonite. L. S. T.

Gas occlusion in the potassium salt deposits of the Verkhnekamsk district. J. V. MORATSCHEVSKI, A. G. SAMARTZEVA, and A. A. TSCHEREPENNIKOV (Kalii, 1937, **6**, No. 7, 24—31).—Gas occlusion occurs mainly in the carnallite strata. The gas consists chiefly of N_2, H_2, and CH_4 and is held in the seam at pressures up to 50 atm.; it can be present in the voids of the mineral or it can be widely dispersed. Methods of determination are described and analyses are given. The origin and mode of formation of the gases are discussed and it is considered that the gases were trapped during the period of crystallisation of the salts. The N_2 : A ratio shows that the N_2 originated most probably from biochemical processes. CH_4 and homologues were formed by decomp. of org. substances. D. G.

Potash salts in the region of the Inder (Uralsk) lake. N. S. KURNAKOV, N. I. BUJALOV, I. N.

LEPESCHKOV, and D. I. RIABTSCHIKOV (Kalii, 1937, 6, No. 5—6, 5—18).—The Inder lake is fed by waters rich in Mg and K emanating from springs. Concn. of the brine to saturation with respect to KCl shows that it is a saturated solution of NaCl and KCl in presence of 42·76 mols. of $MgCl_2$ per 1000 mols. of H_2O, *i.e.*, a quaternary system similar to that of the waters of the Solikhamsk district. The salt deposits originate from an ancient Permian sea; they are considered to be a very promising and abundant source of K. Analyses of the spring waters and geological charts are given. D. G.

Glaserite in the Inder (lake). A. N. VOLKOV (Kalii, 1937, 6, No. 7, 14—23).—The nature of the mineral deposits on the north shore of the Inder lake (Uralsk) is described with the aid of analyses of bore-hole samples. Glaserite begins to occur at a depth of about 170 ft., below the gypsum strata. The thickness of the deposit is about 24 ft. and the average $K_3Na(SO_4)_2$ content is 80·08%, the residue consisting mainly of halite with smaller amounts of gypsum and $MgSO_4$. Below the glaserite layer there are deposits of sylvinite the purity of which varies with the depth. D. G.

Accuracy of chemical analyses of amphiboles and other silicates. E. S. LARSEN (Amer. J. Sci., 1938, [v], **35**, 94—103).—Detailed analyses of six amphiboles made on the same samples of powdered material by from two to four commercial analysts show disquieting discrepancies. Small amounts of F are usually overlooked, but this will not account for differences of 2·5% in the determination of SiO_2, TiO_2, and Al_2O_3, or of >4% of CaO. Further errors in rock analyses are introduced by imperfect sampling when the grain-size is large. L. J. S.

Magmatic segregation and mineralisation at the B.C. Nickel Mine, Chaote, B.C. H. C. HORWOOD (Trans. Roy. Soc. Canada, 1937, [iii], **31**, IV, 5—14).—The nickeliferous sulphides, and the hornblendite and pyroxenite with which they are associated, are described. Samples of ore from the sulphide bodies averaged Fe 18·38, S 10·87, Ni 1·89, Cu 0·70, Cr 0·31, Co 0·14% and As trace. Ag, Au, Pt, and Pd are also present. The petrological and mineralogical criteria, the structural and textural relationships all indicate that both the hornblendite and the included sulphide bodies were formed by processes of magmatic segregation. L. S. T.

Magma and ore deposits. F. F. OSBORNE (Trans. Roy. Soc. Canada, 1937, [iii], **31**, IV, 121—128).—A general discussion of the processes of ore deposition from magma. L. S. T.

Petrogeny of the major acid intrusives of the Rouyn-Bell River area of N.W. Quebec. W. C. GUSSOW (Trans. Roy. Soc. Canada, 1937, [iii], **31**, IV, 129—161).—Seven of the larger "granite" masses of the Au-bearing district of this area have been investigated. Chemical analyses of their various phases are recorded. L. S. T.

Hydrothermal leaching of iron ores. C. O. SWANSON (Econ. Geol., 1937, **32**, 855—857).—A criticism (cf. A., 1937, I, 382). L. S. T.

Paragenesis of iron sulphides in a Black Hills deposit [near Deadwood, S. Dakota]. G. M. SCHWARTZ (Econ. Geol., 1937, **32**, 810—825). L. S. T.

Life history of the Sudbury nickel irruptive. IV. Mineralisation. W. H. COLLINS (Trans. Roy. Soc. Canada, 1937, [iii], **31**, IV, 15—43; cf. A., 1937, I, 101).—The sequence of events resulting in ore deposition and mineralisation at Sudbury has been traced from a re-examination of the geology of the whole field, particularly of the Ni irruptive. L. S. T.

Size-grading of sand by wind. R. A. BAGNOLD (Proc. Roy. Soc., 1937, **A**, **163**, 250—264).—In samples of æolian sand deposits the grades on either side of the mean diameter fall in % wt. according to an exponential law. A simple cycle of sand movement is experimentally realised and the factors controlling the process of grading have been investigated. The results are applied to a typical sand dune. G. D. P.

Lower Bunter sandstones of N. Worcestershire and E. Shropshire. F. W. SHOTTON (Geol. Mag., 1937, **74**, 534—553).—Mechanical analyses are recorded. The Lower Bunter consists of sand of an average grain size of approx. 0·2 mm. Particles <0·05 and >1 mm. are virtually absent. An æolian origin is indicated. L. S. T.

***X*-Ray investigations on clays. III. Differentiation of micas by *X*-ray powder photographs.** G. NAGELSCHMIDT (Z. Krist., 1937, **97**, 514—521; cf. A., 1934, 274).—Powder *X*-radiograms are made with Cu $K\alpha$ or Fe $K\alpha$ radiation for 8 micas of quoted composition, n_α, n_γ, and ρ. By spacings and intensities, two mica types, muscovite and phlogopite-biotite, are distinguished; more detailed differentiation is limited. The scope of the results as criteria in the mineralogical analysis of fine-grained mixtures is indicated. I. McA.

Czechoslovak meteoric stones. J. KOKTA (Coll. Czech. Chem. Comm., 1937, **9**, 471—496).—Chemical analyses are recorded and discussed for the silicate portion and for the Fe and troilite portion of meteorites found at Sazovice near Zlín, Lysá nad Labem in Bohemia, Kravín near Tábor in Bohemia, Praskolesy near Beroun in Bohemia, and Kňahyňa in Subcarpathian Russia. Microchemical methods for the determination of SiO_2, $R^{III}_2O_3$, CaO, MgO, FeO, P_2O_5, Na_2O, K_2O, MnO, Cr_2O_3, S, Fe, Ni, and Co are described. L. S. T.

Presence of sterols in fossils. N. L. COSMOVICI (Bull. Soc. Chim. biol., 1937, **19**, 1583—1584).—Certain bituminous shales contain sterols, the amounts of which vary according to the nature and type of the fossils present. A. L.

Sporopollenins from brown coals. XIV. Membranes of spores and pollen. F. ZETZSCHE and E. ZIEGLER (Brennstoff-Chem., 1937, **18**, 481—482; cf. A., 1937, III, 85).—Analyses of sporopollenins from Gieseltal, Saarau, and Wetterau brown coals are recorded. Comparison with analyses of more recent sporopollenins shows that those from Saarau and Wetterau coals have undergone oxidation. A. B. M.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

APRIL, 1938.

Spectroscopic studies in the extreme ultra-violet. T. SUGA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, **34**, 7—31).—The extreme ultra-voilet spectra of H_2, He, and Ne down to about 500 A. have been studied. Several spectral series have been extended and studied with different types of excitation (a.c. disruptive discharge, d.c. arc, etc.). The changes in intensity of certain Ne I lines in presence of a trace of He are discussed. Many forbidden lines appear in the disruptive discharge of He I. R. S. B.

Relativistic Stark effect of ionised helium. B. KULLENBERG (Nature, 1938, **141**, 244—245). L. S. T.

Nitrogen after-glow. G. W. EWING (J. Chem. Educ., 1937, **14**, 487—491).—A summary of published work. L. S. T.

Action of metastable atoms on the current strength of the non-self-supporting discharge in neon. I. I. GLOTOV (Physikal. Z. Sovietunion, 1937, **12**, 235—255).—5×10^{-4}% of A in Ne increases the current strength (i) in a discharge at 50 v. by 17%. i increases with % of A to a max. at 1% of A, and then decreases. i decreases on illuminating the discharge with Ne light, the effect increasing with % of A to a max. at 10^{-2}% of A, and then decreasing to 0 at 0·2—0·3% of A. Results are interpreted as collisions of the second kind. R. S. B.

Measurement of the ionisation coefficient in pure neon and neon–argon mixtures. I. I. GLOTOV (Physikal. Z. Sovietunion, 1937, **12**, 256—268; cf. preceding abstract).—The ionisation coeff. has been determined in pure Ne and mixtures with A. It is only slightly increased by [A] $< 10^{-3}$%, but with $>10^{-3}$% A increases rapidly with [A]. R. S. B.

Interference measurements in the first spectra of neon, argon, and krypton between 4812 and 3319 A. C. J. HUMPHREYS (J. Res. Nat. Bur. Stand., 1938, **20**, 17—32).—The λλ of the lines in the Ne I, A I, and Kr I spectra have been determined relative to the International Wave-Length Standards in the Kr I spectrum. J. W. S.

Seventh spectrum of chlorine (Cl VII). L. W. PHILLIPS (Physical Rev., 1938, [ii], **53**, 248—249).—Data and classifications of 22 lines locating 18 energy levels, with abs. term vals., are tabulated. The ionisation potential is 113·73 v. N. M. B.

Stark effect in argon and krypton. J. S. FOSTER and C. A. HORTON (Phil. Trans., 1938, **A, 236**, 473—496).—The Stark effect displacements observed for 86 normal levels in A and 75 levels in Kr with a field of 100 kv. per cm. are given. Seven levels in A and 6 in Kr show reversal of direction of displacement with increasing field. Electric combination lines are less numerous in A (34) than in Kr (48). Some lines in the arc spectra of A and Kr have been identified by their Stark effects, and some corrections to the earlier work of Ryde are suggested. A. J. M.

Infra-red spectra of iron, titanium, and carbon. C. C. KIESS (J. Res. Nat. Bur. Stand., 1938, **20**, 33—37).—New lines in the arc spectra of Fe and Ti are recorded in the λ range 10,000—12,000 A. A new term e'^3P has been detected in the Ti spectrum. Previously known lines in the C spectrum have been photographed with high dispersion to obtain accurate λ vals. for use in identifying infra-red lines in the solar spectrum. A new band in the infra-red spectrum of CN is recorded. J. W. S.

Fine structure of the first spark spectrum of arsenic in the visible region. S. K. MUKERJI (Indian J. Physics, 1938, **11**, 377—392; cf. A., 1937, I, 486).—Using a hollow-cathode discharge tube containing As with He continuously circulating at low pressure, the hyperfine structure of a no. of the stronger lines in the region λλ 7000—4300 has been measured and a detailed analysis is reported. The nuclear spin 3/2 is confirmed. N. M. B.

Zeeman effect in strong magnetic fields. P. JACQUINOT (Ann. Physique, 1938, [xi], **9**, 236—317).—Using improved apparatus, and a magnetic field parallel to the high-frequency discharge, lines of Hg, Zn, Li, Cs, and Ne, obtained with fine definition and intensity, were investigated with the help of a Rowland grating spectrograph. The λ 6708 Li line shows for the first time that the components of the Paschen–Back triplet have fine structure. The Houston theory of intermediate coupling is extended to the Paschen–Back effect in all such cases and to calculate displacements for all field vals. and extreme j–j coupling. Experimental results for a no. of Hg lines do not agree satisfactorily with theory, but in the case of certain Ne configurations, where the coupling is better defined, agreement is found, and the existence of a Paschen–Back effect for extreme j–j coupling is shown for the first time; the effect, although small, has been studied as a function of variations of coupling, and results and g vals. are in good agreement with theory. N. M. B.

Optical investigations of the discharge in metallic vapours. IV. Absolute concentration of excited atoms in a mercury discharge at low pressures. V. FABRIKANT, F. BUTAEVA, and I. ZING (Physikal. Z. Sovietunion, 1937, **11**, 576—

589).—The concns. of excited atoms in the $6^3P_{0,1,2}$ states in a Hg discharge at low pressure (10^{-4}—10^{-2} mm.) were found by absorption determinations with lines 5461 A. (6^3P_2—7^3S_1), 4358 A. (6^3P_1—7^3S_1), and 4047 A. (6^3P_0—7^3S_1), current 3 amp. The vals. obtained lie between 10^{11} and 10^{12} atoms per c.c. The results differ considerably from those calc. from a Boltzmann distribution of atoms between the excited states, showing that there is not a state of temp. equilibrium in the discharge. The distribution of atoms between the states investigated corresponds with the excitation functions calc. by Penney (A., 1932, 442) for these states. In contrast to optical excitation the highest concn. of excited atoms is found in the highest state. A. J. M.

Spectrum of Hg I. K. Murakawa (Z. Physik, 1938, **108**, 168—170).—A new series in the spectrum of Hg I is reported. It arises in the transition from the term $md^{3,1}D$ to a new term $5d^96s^26p^3D_3$. The position of the term $5d^96s^26p^1F_3$ is discussed. H. C. G.

Displacement of the Hg resonance line, 2536·7 A. S. Rajski (Physikal. Z. Sovictunion, 1937, **12**, 334—338).—The displacement of the max. of the resonance line of Hg has an upper val. of 0·1 A. at 7·2 atm. and 500°. R. S. B.

Hyperfine structure of the forbidden mercury line 2655·8 A. (6^3P_0—6^1S_0). S. Mrozowski (Z. Physik, 1938, **108**, 204—211).—The forbidden Hg arc line 2655·8 A. was excited optically in a mixture of Hg vapour and N_2. Its hyperfine structure shows the presence of two components arising from the two Hg isotopes of odd at. no. The genesis of the line is discussed. H. C. G.

Near infra-red spectrum of Hg I. T. Suga, M. Kamiyama, and T. Sugiura (Sci. Papers Inst. Phys. Chem. Tokyo, 1937, **34**, 32—49; cf. A., 1929, 1116).—The infra-red spectrum of Hg I has been studied for λ 6700—13,700 A. R. S. B.

Atmospheric absorption and molecular diffusion according to the measurements of the Smithsonian Institution at Montezuma. T. Kiu (Compt. rend., 1938, **206**, 452—455).—Theoretical. A. J. E. W.

Yellow radiation of the nocturnal sky. J. Cabannes and J. Dufay (Compt. rend., 1938, **206**, 221—224).—The λ of the yellow line in the night sky spectrum is 5894±1 A. The line is of complex structure, and may consist of the D_1 and D_2 lines at approx. equal intensities. A. J. E. W.

New fluorescence phenomenon in the upper atmosphere. Presence of variations of intensity in the λ 5893 A. radiation in the light of the sky at twilight. R. Bernard (Compt. rend., 1938, **206**, 448—450).—The line at 5893 A. is probably of the same origin as the yellow radiation of the night sky (see preceding abstract), and is apparently produced at an altitude of 60—80 km. It may be due to photoluminescence caused by absorption in the ultra-violet by O_3, or to resonance of Na atoms. A. J. E. W.

Altitude effects in the red part of the auroral spectrum and the two types of red auroras. L. Vegard (Nature, 1938, **141**, 200). L. S. T.

Spectrum of the Finsler comet in the visible region. J. Gauzit (Compt. rend., 1938, **206**, 169—170).—CO^+ bands, the CN spectrum in the red, and the first positive system of N have been observed in the spectrum of the head of the comet. Their occurrence is discussed. A. J. E. W.

Influence of a magnetic field on the potential gradient in plasma. E. Reichrudel and G. Spivak (Compt. rend. Acad. Sci., U.R.S.S., 1938, **18**, 177—179).—Although there are regions where the potential gradient changes in a magnetic field are insignificant, these changes sometimes reach 50—60%. The influence of a uniform longitudinal field on Hg vapour, Ne, and A has been examined. A quant. theory of plasma must be developed before these effects on the gradient can be interpreted completely. W. R. A.

Excitation of atomic jets by electronic bombardment. R. Planiol (Ann. Physique, 1938, [xi], **9**, 177—235).—In order to obtain a very intense source of positive ions in vac., the use of at. jets intersected by an electron beam was developed. Hg and Cd and initial ion currents 10—65 μa., subsequently augmented by experimental modifications to 40 ma., were employed. The intense luminous jet was studied spectroscopically in the visible and ultra-violet to 2100 A. The spectra consist of arc lines and higher order spark lines. Cd_2 bands in the region of the resonance 2288 line and the second 3261 A. resonance line were observed. On varying the velocity of electrons meeting the jet over 70—500 v., a weakening of the arc and spark lines of the first order and an enhancement of the lines of higher orders were found. λλ, terms, intensities for various electron energies, and origins of lines are tabulated. N. M. B.

Explanation of the character of the positive column of the low-pressure discharge from the elementary processes. R. Rompe and M. Schön (Z. Physik, 1938, **108**, 265—278).—Theoretical. L. G. G.

***X*-Ray spectroscopic data in regard to the electronic energy bands in potassium and sodium chlorides.** J. Valasek (Physical Rev., 1938, [ii], **53**, 274—277; cf. A., 1935, 1046; Slater, A., 1937, I, 8).—The λλ of several lines in the $K\beta$ group of Cl in NaCl and KCl, and of K in KCl were measured in the secondary radiation from pressed blocks of the salts. Results, discussed in terms of the electronic energy bands in the crystals, show that certain of the weaker lines arise from transitions of valency electrons of one of the ions into a K shell vacancy in the other ion. Some of the non-diagram lines seem to be related to the excited levels in irradiated crystals. N. M. B.

Röntgen absorption spectra of RbCl, RbI, and Rb_2SO_4. A. E. Sandström (Ark. Mat. Astron. Fys., 1935, **B**, **25**, No. 8, 4 pp.; Chem. Zentr., 1936, i, 4871).—No systematic variation was found in the λλ of the L_{II} and L_{III} absorption edges, but the

associated " white line " is both narrower and displaced towards longer λλ on passing from RbCl to Rb_2SO_4. J. S. A.

Energy states of valency electrons in some metals. I (7). Emissions and absorptions of some X-rays in zinc and zinc oxide. I (8). Computation of the heat of sublimation of zinc from its energy levels. M. SATO (Sci. Rep. Tôhoku, 1937, **26**, 341—376, 377—382; cf. A., 1936, 1316; 1937, I, 414).— I (7). The K absorption of X-rays by Zn comprises a main process, involving transition from the k shell or the $(1s)^2{}^1S_0$ level to the $(4s,4s)^1P_1$ level of Zn I, and producing the main K absorption edge, and an auxiliary process, which is an Auger effect and gives rise to breadth and fine structure in the main absorption edge and to the $K\beta_2$ and $K\beta'''$ emission lines. In the $L_{II,III}$ absorption the main process is electron transition to the $(4s,6p)^3S_1$ optical level of the triplet system of Zn I, and the auxiliary process to electron transitions between the levels of this triplet system. The main processes in ZnO are similar, but the auxiliary processes comprise electron transitions between the at. levels of O, causing shifting of the absorption edges.

I (8). The heat of sublimation of solid Zn, calc. from the elevation and depression of the crystal levels from the normal state of the isolated Zn atom, is 0·099 Ryd. per atom, in accord with the mean val. between 0° K. and the m.p., deduced from experimental data. J. W. S.

Effect of cathode material on the second Townsend coefficient for ionisation by collision in pure and contaminated nitrogen. W. E. BOWLS (Physical Rev., 1938, [ii], **53**, 293—301).— In view of probable Hg contamination of gases and electrodes in all previous work on the Townsend coeffs., measurements were made on pure N_2 and N_2 contaminated with Na and Hg vapours, using Pt, Na, and Hg cathodes. Full data are plotted, the discrepancies and anomalies found are discussed, and explanations are examined. N. M. B.

Effect of electric field on surface ionisation. L. N. DOBREZOV (Physikal. Z. Sovietunion, 1937, **11**, 647—659).—The degree of ionisation of Na and K after their neutral atoms have fallen on incandescent W has been determined as a function of the electric field applied at various temp. The results do not agree with the theory of Morgulis (A., 1935, 1298). The phenomenon may be explained as a Schottky effect. A. J. M.

Mechanism of emission from barium oxide cathodes. R. SUHRMANN and G. FRÜHLING (Naturwiss., 1938, **26**, 108).—In the experimental investigation of the mechanism of electron emission from BaO cathodes the variation of thermionic emission with temp. is determined and the quantity const., A, and the emission potential were calc. from Richardson's equation, or by means of an exponential function on the assumption that A and ω do not vary with temp. Experiments are described showing that this assumption is not justified. ω has a negative temp. coeff. of $1{\cdot}5 \times 10^{-3}$ v. per degree, and A is doubled on heating from 300° to 400°. A. J. M.

Photo-electric sensitisation of aluminium. L. P. THEIN (Physical Rev., 1938, [ii], **53**, 287—292). —The increase in photo-current from Al which has been subjected to H_2 glow discharges depends on the time of discharge and H_2 pressure. If the target is not outgassed there is a rapid decay after sensitisation on account of diffusion of gas from the body of the metal to the surface. The sensitisation is mainly due to " clean-up " of the oxide-coated surface. Glow discharges have little effect on the yield from freshly evaporated Al. Another type of sensitisation is effected by exposing such a surface to traces of dry air, and the effect of the glow discharge is one of desensitisation. The current–voltage curve for freshly distilled Al agrees with that of the Du Bridge theory, but in the case of air-sensitised surfaces there is no agreement. The threshold val. for a film approaching bulk thickness is 2840 A. N. M. B.

Exchange of energy by electron collision in low-pressure discharge columns. G. MIERDEL (Naturwiss., 1938, **26**, 79).—Expressions for the energy loss by elastic and inelastic collisions are given, and the calc. connexion between electron temp. and field strength for Ne is plotted. The curve agrees satisfactorily with experimental results. A. J. M.

Theory of the motion of electrons in gases and semi-conductors. B. DAVIDOV (Physikal. Z. Sovietunion, 1937, **12**, 269—300).—Expressions are deduced for the current in semi-conductors, and the current, diffusion, and thermal conductivity in the gaseous discharge, in both the presence and absence of a magnetic field. R. S. B.

Temperature of electrons in a magnetic field. A. SLUTZKIN (Physikal. Z. Sovietunion, 1937, **12**, 215—232).—The effect of a magnetic field on the electron temp. in a discharge tube has been investigated. Two groups of electrons of different velocities were detected. There is a rapid decrease in the electron temp. in a direction perpendicular to the magnetic field with increasing distance from the centre of the bundle of rays. The temp. gradient in this direction was approx. determined. A. J. M.

Energy absorption of fast cathode rays. K. GENTNER (Ann. Physik, 1938, [v], **31**, 407—424; cf. A., 1936, 543).—Measurements have been made of the angular and velocity distribution of electrons from an electron beam of 25·6 kv. energy passing through Al, and of the velocity distribution of back-diffusing electrons at different depths in the Al layer. The absorption of electrons at different depths in the Al is calc. and the nature of the absorption process discussed. O. D. S.

Anomalous scattering of fast electrons. D. MASURENKO (Physikal. Z. Sovietunion, 1937, **12**, 360—365).—Theoretical. The high-angle scattering in N_2 found by Skobelzyn and Stepanova (A., 1936, 540) does not conform to the Mott formula. I. McA.

Two-quantum states of the positive molecular hydrogen ion. M. V. BELIKOV and B. N. FINKELSTEIN (Physical Z. Sovietunion, 1937, **12**, 307—312). —A wave-mechanical calc. of the two-quantum terms

of H_2^+ is given and is in fairly good agreement with the results obtained by numerical methods. R. S. B.

Negative ions in discharge tubes. K. G. Emeléus and J. Sayers (Proc. Roy. Irish Acad., 1938, **44**, A, 87—100).—The effects produced by negative ions of mol. dimensions in discharge tubes have been investigated and rules are given for the effect of their presence on structure and conductivity. Approx. quant. treatment of some of the processes which destroy negative ions in the gas phase is given and is capable of extension to the calculation of equilibrium concns. A similar method is employed to determine max. concn. of negative ions produced by surface conversion of negative ions in the Hg arc. A discharge tube source of O ions is described. W. R. A.

Diffraction of thallium and cadmium atom rays at surfaces. G. Vészi (Z. physikal. Chem., 1938, B, **38**, 424—426; A., 1931, 162).—Diffraction rings were observed on condensing beams of Tl or Cd atoms on a cooled surface after first reflecting them from a rotating oil surface. The phenomenon is interpreted by analogy with the diffraction of de Broglie waves. H. J. E.

Scattering of protons by protons. L. R. Hafstad, N. P. Heydenburg, and M. A. Tuve (Physical Rev., 1938, [ii], **53**, 239—246; cf. A., 1937, I, 5).—The extension of measurements to the energy region 200—600 kv. gives results which can be explained only by the assumption of a strong attractive force of short range acting in addition to the repulsive Coulomb forces between the particles and in approx. quant. agreement with calculation. N. M. B.

At. wt. of neodymium. O. Hönigschmid and F. Wittner (Z. anorg Chem., 1938, **235**, 220—224). —Determination of the ratios $NdCl_3 : 3Ag$ and $NdCl_3 : 3AgCl$ for two Nd preps. gave at. wt. as 144·27, in complete agreement with the International val. F. J. G.

Isotopic constitution of calcium, titanium, sulphur, and argon. A. O. Nier (Physical Rev., 1938, [ii], **53**, 282—286; cf. A., 1938, I, 5).—A mass-spectrographic study revealed new isotopes ^{46}Ca and ^{48}Ca with respective abundances 1/29,000 and 1/520 that of ^{40}Ca, also ^{36}S, abundance 1/6000 that of ^{32}S. No new Ti isotopes were found and ^{42}A was looked for unsuccessfully. N. M. B.

Periodic system. E. C. Payne (J. Chem. Educ., 1937, **14**, 593—594).—Zmaczynski's arrangement (A., 1937, I, 429) is modified. L. S. T.

Warping the periodic table. S. J. French (J. Chem. Educ., 1937, **14**, 571—573).—The table is arranged as a graph by plotting each element horizontally according to at. no. and vertically according to chemical behaviour. Advantages thus obtained are discussed. L. S. T.

Mass spectrograph of high intensity and the separation of rubidium isotopes. W. Walcher (Z. Physik, 1938, **108**, 376—390).—A detailed account of work already noted (A., 1938, I, 110).

Alteration of nuclear spin in the radioactive β-decomposition process $^{87}Rb \rightarrow {}^{87}Sr$. M. Heyden and H. Kopfermann (Z. Physik, 1938, **108**, 232—243).—From hyperfine structure measurements with pure ^{87}Sr it is shown that one of the general relations required by theory to exist between the life period of a β-ray and the change of nuclear spin in a β-decomp. process, is realised in the radioactive β-decomp. $^{87}Rb \rightarrow {}^{87}Sr$. The mechanical nuclear moment of ^{87}Sr is $I = 9/2$; the magnetic nuclear moment is $\mu = 1{\cdot}1$. The difference between the mechanical nuclear moments of ^{87}Sr and ^{87}Rb is $\Delta I = 3$. H. C. G.

Low energy region of the β-spectrum of (A) Ra-*E*, (B) Th-*C*″ and Th-*B*. A. I. Alichanian and A. S. Zavelski (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 467—468, 469—470).—(A) The elimination of corrections for absorption in the window of the counter (cf. A., 1937, I, 388), by the use of a window of greater transparency, gives an electron energy distribution curve in good agreement with theory.

(B) A comparison of the theoretical and experimental curves is given and discussed. N. M. B.

Absorption limits for the primary β-particles of mesothorium 2 and uranium-X_2. N. Feather (Proc. Camb. Phil. Soc., 1938, **34**, 115—119).—The absorption limits for the primary β-particles of meso-Th and U-X_2 have been determined using modified counters of various types, and are in good agreement with the vals. obtained using Au leaf electroscopes. F. J. L.

Continuous β-spectrum of thorium-*B*. R. Arnoult (Compt. rend., 1938, **206**, 184—186; cf. A., 1926, 990).—The electronic energy spectra of the disintegrations Th-*B* → -*C* and Th-*C* → -*C*′ + Th-*C*″ → -*D* have been studied photographically for energies < 15 ekv. The former gives a large no. of electrons of low energy; approx. one electron is emitted per atom disintegrated, the mean energy being 102 ekv. A. J. E. W.

Heavy β-particles. A. Ruark and C. C. Jones (Physical Rev., 1938, [ii], **53**, 264—265; cf. Jauncey, A., 1938, I, 115).—Analysis of data for tracks of Ra-*E* β-particles in N_2 and O_2 is strongly opposed to the existence of heavy particles from nuclear reactions. N. M. B.

Existence of heavy β-rays. H. R. Crane (Physical Rev., 1938, [ii], **53**, 317).—In view of a suggested difference of behaviour between nuclear and extranuclear β-rays, the absorption of groups of β-rays from the centre and upper limit of the ^8Li β-ray spectrum was measured, the latter group having been slowed to the same momentum as the first by passage through C. Results showed that the rays from two such widely separate regions were absorbed in C to approx. the same extent, in opposition to theoretical prediction (cf. Jauncey, A., 1938, I, 111). N. M. B.

Heavy β-rays. G. E. M. Jauncey (Physical Rev., 1938, [ii], **53**, 265).—Further analysis of photographs of the mass spectra of electrons (cf. A., 1938, I, 111) supports the existence of heavy electrons. N. M. B.

Heavy electrons from radium-*E*. G. E. M. JAUNCEY (Physical Rev., 1938, [ii], **53**, 319).—A discussion of objections raised against evidence previously reported (cf. A., 1938, I, 111, and preceding abstract). N. M. B.

Absorption of the γ-rays of radium. G. J. SIZOO and H. WILLEMSEN (Physica, 1938, **5**, 100—104).—From the theories of scattering, photo-absorption, and the creation of pairs, the total absorption coeffs. for the $\lambda\lambda$ corresponding with the various components of the γ-radiation of Ra are calc., and, with the help of experimental intensities of these components, the absorption curves for Al, Fe, Cu, Sn, and Pb are found. Results are in agreement with the absorption measurements of Kohlrausch. N. M. B.

Efficiency of a γ-ray counter. G. J. SIZOO and H. WILLEMSEN (Physica, 1938, **5**, 105—110).—A method is described for determining the sensitivities of a γ-ray counter for the various $\lambda\lambda$ of the monochromatic components of a heterogeneous γ-radiation if the intensities and absorption coeffs. of these components are known. Results on the absorption in Pb of the γ-radiation of Th-B + C were satisfactory, but in the case of Ra were inconclusive, probably on account of insufficiently accurate data, and sensitivities were found by trial. N. M. B.

D–D nuclear reaction. G. KALLMANN and E. KUHN (Naturwiss., 1938, **26**, 106—107).—The emission of γ-rays in the D–D nuclear reaction has been demonstrated. Their existence explains discrepancies in the determination of the no. of rapid neutrons emitted when counters of different type are used. A. J. M.

Wilson chamber photograph of the neutro-electric effect. S. KIKUCHI and H. AOKI (Nature, 1938, **141**, 328).—Photographs showing the emission of the electron from atoms when they interact with neutrons are reproduced. The expulsion of an orbital electron or an electron in a negative state, due to some unknown interaction between the electron and heavy particles, is assumed. L. S. T.

Slowing down of neutrons by thin layers of paraffin. N. NISHIKAWA, S. NAGAKAWA, and I. SUMOTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, **34**, 1—6).—The absorption of neutrons from Rn + Be has been studied in Cd, Ag, KBr, and KI, after passage of the neutrons through varying thicknesses of paraffin. R. S. B.

Diffusion of thermic neutrons in aqueous solutions of cadmium nitrate. F. KNAUER (Z. Physik, 1938, **108**, 153—161).—The effect of the addition of Cd salts on the concn. of thermic neutrons in H_2O is derived from the diffusion equation. This relation is confirmed by measurements from which relative vals. for the absorption cross-sections of Cd and H atoms are calc. free from any scattering effect. H. C. G.

Neutrons from lithium plus deuterons. W. E. STEPHENS (Physical Rev., 1938, [ii], **53**, 223—226; cf. Bonner, A., 1936, 6).—Using the method of α-recoils in a He-filled high-pressure cloud chamber (cf. *ibid.*, 1174), measurements of the energy distribution of the neutrons from the disintegration of Li by deuterons show two groups with disintegration energies of $15{\cdot}05\pm0{\cdot}2$ and $11{\cdot}8\pm0{\cdot}4$ m.e.v., attributed respectively to the formation of ^{8}Be in a normal state and ^{8}Be in an excited state of about 3·3 m.e.v. with a width at half-max. of about 1·5 m.e.v. An approx. continuous distribution over 9—3 m.e.v. may be due to neutrons from higher wider states of ^{8}Be. N. M. B.

Neutron absorption in boron. H. C. TORREY (Physical Rev., 1938, [ii], **53**, 266—267).—Mathematical. A method for the determination of slow neutron energy distributions and of the energy shapes of capture cross-sections in certain elements is developed, and other applications are suggested. N. M. B.

Slow neutron disintegration of ^{10}B and ^{6}Li. M. S. LIVINGSTON and J. G. HOFFMAN (Physical Rev., 1938, [ii], **53**, 227—233).—The disintegration of ^{10}B by slow neutrons gives groups of α-particles of ranges $0{\cdot}80\pm0{\cdot}03$ and $0{\cdot}66\pm0{\cdot}05$ cm. and relative intensities 1 : 3, corresponding with disintegration into the ground state of the ^{7}Li product nucleus and the 0·44 m.e.v. excited state, respectively. The reaction energies obtained from these ranges agree with those calc. from at. masses. The slow neutron disintegration of ^{6}Li gives ^{3}H particles of $5{\cdot}90\pm0{\cdot}06$ cm. range, indicating a reaction energy of 4·86 m.e.v. This is not in accord with the val. obtained from at. masses. N. M. B.

Absorption of group *C* neutrons in silver, cadmium, and boron, at different temperatures. F. G. HOUTERMANS, A. I. LEIPUNSKI, and L. RUSINOV (Physikal. Z. Sovietunion, 1937, **12**, 491—492; cf. A., 1936, 1314).—Using as detector the 200-sec. Ag activity (Ag, Cd, B), or a B-lined ionisation chamber + amplifier (B only), absorption measurements at 20°, 77°, 290°, 300°, and 463° K. show that the $1/v$ law holds for B and Ag, but not for Cd. Absorption coeffs. at low temp. are < those calc. from a Maxwellian distribution of neutron energy. I. McA.

Nuclear isomerism of rhodium. H. REDDEMANN (Naturwiss., 1938, **26**, 125).—Bombardment of Rh with rapid neutrons (2·4 e.m.v.) from the D + D reaction gives active isotopes of half-life 40 sec. and 4 min., respectively, the activity of the 40 sec. nucleus being three times that of the 4 min. nucleus. If slow instead of fast neutrons are used the ratio of the activities is greater. The two nuclei may be isomeric nuclei, at. wt. 104. A. J. M.

Addition processes with rapid neutrons. H. REDDEMANN (Naturwiss., 1938, **26**, 124—125).—Although slow neutrons are particularly effective in bringing about nuclear transformations with production of higher isotopes, rapid neutrons can produce a similar, though weaker, effect. To investigate the energies of rapid neutrons which will induce reactions of the type (n, γ) Al, Cu, Br, Rh, Ag, and I were bombarded with neutrons from the D + D reaction (2·4 e.m.v.) and the activity was measured. A. J. M.

Nuclear excitation by rapid neutrons. H. KALLMANN and E. KUHN (Naturwiss., 1938, **26**, 107—108).—The emission of γ-rays on bombardment of various elements with rapid neutrons has been investigated. This emission is due to nuclear excitation as is proved in the case of Al. The probability of nuclear excitation is determined as a function of the neutron energy, and results are given in the case of Cu, Fe, Al, and Cd. A. J. M.

Scattering of photo-neutrons from beryllium by deuterium. G. I. SATKOVEZKY (Physikal. Z. Sovietunion, 1937, **11**, 664—666).—The mean cross-section of D for photo-neutrons from Be is found to be $(4{\cdot}7\pm0{\cdot}6) \times 10^{-24}$ sq. cm. A. J. M.

Scattering of photo-neutrons from beryllium by light nuclei. E. FEDEROV and N. PERFILIEVA (Physikal. Z. Sovietunion, 1937, **11**, 660—663).—The cross-sections of light elements (Li—Cl) and some compounds (mol. wt. 26—58) for scattering of photo-neutrons have been determined. They do not increase with at. wt. in the same way as in the case of heavy atoms. A. J. M.

Nuclear photo-effect with simultaneous emission of two neutrons. W. GENTNER (Naturwiss., 1938, **26**, 109).—Sc_2O_3 was irradiated with hard γ-rays of 17 m.e.v., obtained by the bombardment of Li with rapid protons. After the irradiation, a comparatively strong activity with half-life $3{\cdot}9\pm0{\cdot}4$ hr., which must be ascribed to ^{43}Sc, was detected. The reaction is therefore ^{45}Sc $(\gamma, 2n)$ ^{43}Sc, which is also possible from considerations of energy. A. J. M.

Long-period activity of indium produced by slow neutrons. A. C. G. MITCHELL (Physical Rev., 1938, [ii], **53**, 269—272; cf. Lawson, A., 1937, I, 594).—When irradiated for several months with slow neutrons from a Ra–Be source In gave rise to a strong 45 ± 3 days period corresponding with ^{114}In produced by neutron capture from ^{113}In. The activity ratio of the long period to that of 54 min., due to ^{116}In, is approx. the same as the isotope ratio ^{113}In/^{115}In. The capture cross-sections for the two processes are given by $\sigma_{113} = 0{\cdot}56\sigma_{115}$. N. M. B.

***K* Electron capture and isomerism in radio-silver.** M. L. POOL and E. C. CAMPBELL (Physical Rev., 1938, [ii], **53**, 272—274; cf. A., 1938, I, 113).—In view of the possibility of orbital electron capture as an alternative to positron emission by radioactive nuclei, a provisional energy level diagram is constructed for the isomeric ^{106}Ag nucleus. The data used indicate that, for the 8·2-day period, the relative probabilities of K electron capture : negative β-emission : positive β-emission = 640 : 40 : 1. The 24·5-min. ^{106}Ag level is metastable and 0·3 m.e.v. above the 8·2-day ^{106}Ag ground state. N. M. B.

Nuclear transformation by *K* electron capture. E. J. WILLIAMS and E. PICKUP (Nature, 1938, **141**, 199).—Expansion chamber photographs show that a soft X-radiation is emitted from Ti which had been bombarded by fast deuterons, indicating a K-capture transformation. The parent atom has an at. no. 21 ± 1. The probability of K-capture is 1000 times that of the alternative process of emission of a positron. L. S. T.

Photo-disintegration of the deuteron by the γ-radiation from ^{24}Na. J. R. RICHARDSON and L. EMO (Physical Rev., 1938, [ii], **53**, 234—239).—NaF activated by deuteron bombardment in a cyclotron was brought close to a cloud-chamber filled with D_2 at 1 atm. pressure. Stereo-photographs of the tracks of the photo-protons indicated a mean air equiv. range of 4·4 mm. corresponding with a mean energy of 410 kv. This indicates a difference of 820 ± 35 kv. between the energy of the ^{24}Na γ-ray and the binding energy of the deuteron; the respective vals. of these are $3{\cdot}00\pm0{\cdot}05$ (by Compton recoil method) and $2{\cdot}18\pm0{\cdot}07$ m.e.v. The approx. cross-section for disintegration is 1×10^{-27} sq. cm. N. M. B.

Chemical investigation of short-lived radio-elements. A. POLESSITSKI (Physikal. Z. Sovietunion, 1937, **12**, 339—342).—The following nuclear reactions have been studied by chemical means: ^{23}Na + ^1n = ^{24}Na (half-life λ 15·5 hr.; electrons), ^{23}Na + ^1n = ^{1}H + ^{23}Ne (λ = 40 sec., electrons), ^{19}F + ^1n = ^{4}He + ^{16}N (active product of λ 8 sec.; also weak activity of λ 40 sec. not studied), ^{9}Bc + ^1n = ^{4}He + ^{6}He (weak activity, λ 0·9 sec.). R. S. B.

β-Disintegration induced by a central collision of an electron with a heavy particle. A. KOMPANEEZ (Physikal. Z. Sovietunion, 1937, **12**, 138—147).—Theoretical. The probability that a fast electron colliding centrally with a heavy particle (proton or neutron) will bring about a β-disintegration is calc. A. J. M.

Angular distribution of nuclear fragments. C. REINSBERG (Z. Physik, 1938, **108**, 189—194).—The probability of a nuclear particle being scattered in a given direction is calc. from consideration of the conservation of rotational momentum and from the selection principle for nuclear transformations. Results calc. for the processes ^{2}H $(d; p)$ ^{3}H, ^{2}H $(d; n)$ ^{3}He, ^{6}Li $(d; p)$ ^{7}Li, ^{6}Li $(p; \alpha)$ ^{3}He ^{7}Li $(p; \alpha)$ ^{4}He and ^{11}B $(p; \alpha)$ ^{8}Be compare favourably with experimental data where available. H. C. G.

Specific primary ionisation due to cosmic rays. M. G. E. COSYNS (Bull. Acad. roy. Belg., 1937, [v], **23**, 960—972).—Experiments at different altitudes and underground confirm the previous conclusion that the sp. primary ionisation decreases for higher energies (cf. A., 1936, 1315; A., 1937, I, 337, 437). C. R. H.

Disintegration of nuclei by cosmic rays. A. FILIPPOV, A. GDANOV, and I. GUREVITSCH (Compt. rend. Acad. Sci., U.R.S.S., 1938, **18**, 181—183).—Disintegration of nuclei by cosmic rays has been investigated by means of plates impregnated with borax and Li compounds. Photographs of four cases of disintegration into 3 or 4 particles are reproduced and discussed. The particles are α-particles, protons, and semi-heavy particles of mass approx. $\leqslant 800m_e$. W. R. A.

Penetration of corpuscular cosmic rays in matter. J. CLAY and K. H. J. JONKER (Physica, 1938, **5**, 81—89).—An arrangement of counters for finding coincidences in different directions with various thicknesses of Pb shielding is described and

data are tabulated. The no. of shocks produced by those photons which eject an electron from the wall of the counter is 27%. N. M. B.

Analysis of the cosmic radiation complex. J. CLAY (Physica, 1938, **5**, 94—99; cf. preceding abstract).—Further measurements and theory show that if the no. of shocks produced in a single counter by photons is 27%, then from the 73% of corpuscular rays 67% give a coincidence in two steel counters of 1 mm. wall, 11% have energies $<1{\cdot}4 \times 10^6$ e.v., and 55% can penetrate >4 cm. Pb. From measurements of the ionisation in A at different pressures, the ionisation due to the electrons ejected by the photons from the walls and from the gas itself is found, and this, subtracted from the total ionisation, gives the ionisation by the corpuscular rays traversing the chamber. N. M. B.

Soft final corpuscular rays produced by cosmic rays in the walls of an ionisation chamber. J. CLAY and J. DE BOCK (Physica, 1938, **5**, 90—93).—Measurements of ionisation currents between two parallel grids in a special steel vessel containing A up to 150 atm. showed that ionisation $\propto$ pressure; for 75—150 atm. the ionisation produced by electrons from the Cu walls was const. and $\propto$ thickness. Upward ionisation was somewhat < downward. A comparison of the productions from layers of different materials shows that the saturation val. increases with at. wt. N. M. B.

Dependence of ionisation by ultra-radiation on pressure and secondary effects. B. VINZELBERG (Z. Physik, 1938, **108**, 171—182).—Measurements of the ionisation produced by ultra-radiation in air at 1—37 atm. pressure are recorded. Ionisation appears to be produced by two components, a primary radiation of high energy, and a secondary radiation liberated from the walls of the air chamber. The presence of this radiation of lower energy was established by the use of different absorption materials (Pb, Al, and Fe) in the pressure chamber. The relation between pressure and ionisation is different for γ- and ultra-radiations. H. C. G.

Cosmic rays, their absorbability in the atmosphere, and the secondary character of the penetrating rays abundant at sea level. I. S. BOWEN, R. A. MILLIKAN, and H. V. NEHER (Physical Rev., 1938, [ii], **53**, 217—223).—Intensities, ionisations, and penetration of cosmic particles entering the earth's atm. in the energy range $6{\cdot}7 \times 10^9$—17×10^9 e.v. are calc. There is evidence that the observed penetrating particles and all cosmic-ray effects in the lower atm. are secondary effects from the absorption of electrons and/or photons in the outer layers of the atm. N. M. B.

Observations made in the highest stratosphere flight. R. T. P. W. (Nature, 1938, **141**, 270—274).—Measurements of the angular distribution of cosmic rays, and the nature of the constituent corpuscles, the distribution of O_3, and the electrical conductivity and the composition of air in the stratosphere are summarised. Spores of certain moulds and bacteria have been shown to exist in the stratosphere. L. S. T.

Two negatives of penetrating cosmic rays obtained in the Bellevue magnetic field; existence of a heavy particle. P. EHRENFEST, jun. (Compt. rend., 1938, **206**, 428—430; cf. A., 1937, I, 340).—The observation of a cosmic particle which produced a shower of five electrons, with small loss of energy, after traversing 14 cm. of Pb, is recorded. A particle of approx. mass $200m$, which passed through a 5 cm. Pb screen, has also been observed. A. J. E. W.

Ratio of electrons to photons in a cosmic-ray shower. H. GEIGER and O. ZEILLER (Z. Physik, 1938, **108**, 212—217).—The ratio of the ionising to the non-ionising radiation in a cosmic-ray shower was measured in three different ways. Each electron shower was accompanied by a relatively intense and very diffuse photon shower. The ratio of photons to electrons is approx. 50 : 1. H. C. G.

Hoffman collisions and the hard component of ultra-radiation. J. K. BØGGILD (Naturwiss., 1938, **26**, 95).—An experiment is described which shows that the production of electrons by the hard component of ultra-radiation is more nearly $\propto nZ^2$ than to nZ (n = no. of atoms per c.c., Z = at. no.). A. J. M.

Particle of intermediate mass. A. J. RUHLIG and H. R. CRANE (Physical Rev., 1938, [ii], **53**, 266).—Examination of a single pronounced track found in the investigation of the stopping power of Pb for recoil electrons produced by 17 m.e.v. γ-rays from Li + ^{1}H showed a curvature corresponding with 120 ± 15—120 ± 30 times the electron mass (cf. Street, A., 1938, I, 9). Evidence is given that the track is associated with cosmic radiation. N. M. B.

Nuclear photo-effects. N. BOHR (Nature, 1938, **141**, 326—327).—Theoretical. L. S. T.

Ring structure of the electron. B. S. M. RAO (Physikal. Z., 1938, **39**, 187—189).—A purely classical treatment of the ring structure of the electron based on the electromagnetic field equations of Born is not possible (cf. Stark, A., 1937, I, 292, 335). A. J. M.

Physical reality and dogmatic atomic theories. J. STARK (Physikal. Z., 1938, **39**, 189—192).—A reply to Rao (preceding abstract) in which dogmatic theories of the atom are condemned. A. J. M.

[Physical reality and dogmatic atomic theories.] B. S. M. RAO (Physikal. Z., 1938, **39**, 193—194).—A reply to Stark (preceding abstract). A. J. M.

Spin angular momentum of the electron. U. KAKINUMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 187—193).—Theoretical. The half-integral quantum nos. for the electron spin are discussed wave-mechanically. R. S. B.

Non-radiating motion of a spinning electron. J. W. WEYSSENHOFF (Nature, 1938, **141**, 328—329).—Theoretical. L. S. T.

Superquantisation in the wave mechanics of electrons. E. DURANDIN and A. ERSCHOV (Physikal. Z. Sovietunion, 1937, **12**, 466—471).—A crit. examination of Proca's theory (A., 1937, I, 274), which would involve particles of (mean) zero spin

and electric and magnetic moment, obeying Bose statistics. I. McA.

Recent advances in quantum dynamics and nuclear physics. III. Quantum theory of general force fields. E. L. Hill (Rev. Sci. Instr., 1938, [ii], **9**, 40—46).—A discussion of quantised fields by the method of second quantisation. D. F. R.

Creation of electron pairs by nuclear capture of neutrons. H. S. W. Massey (Proc. Roy. Irish Acad., 1938, **44**, A, 77—85).—Formation of electron pairs is regarded as due to a triple collision between the nucleus, the neutron, and an electron in a state of negative kinetic energy. During the collision the energy of the system is redistributed in such a way as to lead to pair formation. An expression is derived for the probability of pair formation. W. R. A.

Electronic energy bands in metallic copper and silver. S. R. Tibbs (Proc. Camb. Phil. Soc., 1938, **34**, 89—99).—Theoretical. F. J. L.

Binding energy of the deuteron. H. A. Bethe (Physical Rev., 1938, [ii], **53**, 313—314).—The data of Chadwick (cf. A., 1938, I, 112) on the photo-disintegration of the deuteron are analysed in terms of the most recent corr. proton range-energy data (cf. Parkinson, A., 1937, I, 488). Results lead to the val. $2{\cdot}17\pm0{\cdot}04$ m.e.v. for the binding energy of the deuteron, and hence the val. $1{\cdot}00893\pm0{\cdot}00005$ for the mass of the neutron. Corr. masses of nuclei are: ^{3}He 3·01711, ^{14}C 14·00763, ^{13}N 13·01008. N. M. B.

Nuclear structure of light atoms. B. M. Sen (Indian J. Physics, 1938, **11**, 427—432).—A conception of the nucleus as a static or quasi-static cryst. structure rather than a dynamic assembly of protons and neutrons is discussed independently of quantum mechanics. The structure of the isotopes of H, He, and Li is considered. Nuclear distances are in approx. agreement with accepted vals., and a simple solution to the β-radiation continuous energy spectrum difficulty is proposed. N. M. B.

Term distances of the atomic nucleus according to the oscillator model. K. Umeda (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 197—204).—Theoretical. The proper frequencies in a heavy nucleus have been studied, with results analogous to those of Bethe. R. S. B.

Energy levels of a heavy nucleus. I. Gurevitsch (Physikal. Z. Sovietunion, 1937, **12**, 489—490).—A modification of Landau's formula (A., 1937, I, 440) is proposed as a better approximation. I. McA.

Theory of the elementary particle. G. Wataghin (Atti R. Accad. Lincei, 1937, [vi], **26**, 282—285).—Mathematical.

Exchange character of the nuclear forces from the β-radiation theory. K. Nakabayasi (Sci. Rep. Tôhoku, 1937, **26**, 261—281; cf. A., 1934, 827).—Mathematical. J. W. S.

Amplitude factor in the Fermi β-decomposition matrix. K. Umeda (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 137—143). R. S. B.

New method of measuring nuclear magnetic moment. I. I. Rabi, J. R. Zacharias, S. Millman, and P. Kusch (Physical Rev., 1938, [ii], **53**, 318).—A beam of mols. traverses a magnetic field sufficiently strong to decouple the nuclear spins, and a small oscillating magnetic field is applied at right angles to a much larger const. field; the latter is varied for some given val. of the oscillating field frequency until resonance is observed by a drop in intensity at the detector, with subsequent recovery when the resonance val. is passed. Calculations based on the reorientation are outlined. Investigations with LiCl showed sharp resonance peaks of Li and Cl. N. M. B.

Relativity and quantum theory. M. Born (Nature, 1938, **141**, 327—328).—Theoretical. L. S. T.

Interstellar matter as the eventual cause of the displacement of the spectrum of the nebulæ towards the red. L. Schamès (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 144—146).—Calculations in support of this are given. L. S. T.

Dissociation of the degenerate gas. A. B. Severni and N. N. Tunitzki (Physical Z. Sovietunion, 1937, **12**, 330—333).—The equilibrium theory for the dissociation of a degenerate gas according to Fermi–Dirac and Bose–Einstein statistics is discussed. R. S. B.

Possibility of a neutrino theory of light. A. Sokolov (Physikal. Z. Sovietunion, 1937, **12**, 148—163; cf., A, 1937, I, 60, 441). A. J. M.

Theory of neutrinos. G. Wataghin (Compt. rend., 1938, **206**, 425—427).—Theoretical. A. J. E. W.

Nature of elementary sources of light and interference phenomena. S. I. Vavilov (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 463—466).—Mathematical. N. M. B.

Mechanism of luminous radiations. C. L. Mayer (Fond. Sci. Phys.-Chim. Paris, 1937, 23 pp.).—Mathematical. A new general theory of radiation is developed, based on the assumption that a radiating body emits simultaneously a double-quantum (magneto-photon) carrying equal and opposite charges and endowed with helicoidal or cycloidal translatory motion. The theory purports to explain the mechanical phenomena of radiation and to unify the contemporary theories of emission, wave-mechanics, and Maxwell's electromagnetics. An analogy with astronomical motions is noted. N. M. B.

Radiation of a doublet by an electric charge. A. Sokolov (Physikal. Z. Sovietunion, 1937, **12**, 472—481).—Mathematical. I. McA.

Intrinsic variability of the so-called fundamental physical constants. F. Zwicky (Physical Rev., 1938, [ii], **53**, 315; cf. A., 1936, 128).—A general survey in the light of recent discoveries. N. M. B.

Planck's function from 3500° to 8000° K. P. Moon (J. Math. Physics, 1937, **16**, 133—157).—Vals. of J_λ (spectral radiosity) calc. from Planck's equation are tabulated corr. to five significant figures, with vals. of first differences for temp. interpolation, for 100°

temp. intervals and λλ 0·26—0·75 (0·01 μ. intervals), 0·75—1·00 (0·05 μ. intervals), and 1·00—3·00 μ. (0·10 μ. intervals). N. M. B.

Absorption spectrum of the atomic solution of tellurium in sulphuric acid. S. Borzova and K. Butkov (Physikal. Z. Sovietunion, 1937, **12**, 458—465).—Absorption coeffs. measured in the λ range 2200—6250 A. show increasing general absorption at λλ >3960 A., and a band at 5180 A. following Beer's law. The strength of the solvent field is interpreted by comparison of the half-val. width of this band ($8·2 \times 10^{13}$ sec.$^{-1}$) with those of other at. solutions (Hg in org. solvents, alkali metals in coloured halide crystals). I. McA.

Band spectrum of thallium hydride. I. B. Grundström and P. Valberg (Z. Physik, 1938, **108**, 326—337).—The band spectra of TlH were photographed over the λ range 4000—7500 A.; all 16 bands analysed show pronounced predissociation. Analysis of the structures shows that the bands arise from five different electronic states. The origin of the dissociation is discussed. L. G. G.

Thermochemistry of isotopes. Absorption spectra and heats of formation of lithium hydride and lithium deuteride. A. F. Kapustinski, L. M. Schamovski, and K. S. Baiuschkina (J. Phys. Chem. Russ., 1937, **10**, 620—626).—The absorption max. of LiH and LiD are at 2517 and 2482 A., respectively. The corresponding frequency ν agrees with the equation $h\nu = q + S + \frac{1}{2}d$, q being the heat of formation of LiH, S the heat of sublimation of Li, and d the heat of dissociation of H_2. q of LiD calc. from this equation is 23·6 kg.-cal. J. J. B.

Luminous phenomena in the cold oxidation of phosphorus and the determination of the dissociation energy of PO. K. Rumpf (Z. physikal. Chem., 1938, **B**, **38**, 469—473).—Fifteen bands (λλ 3268—6472 A.) in the spectrum of the cold flame of P were photographed and classified. They are attributed to PO. The same bands occur in the spectrum of the hot flame of PH_3. The dissociation energy of PO is 6·2 v. H. J. E.

Internal recombination in the photodissociation of polyatomic molecules. A. Terenin and R. Tschubarov (J. Phys. Chem. Russ., 1937, **10**, 636—653).—SnI_4 vapour passed at 280—560° through a tube irradiated with 2450—2150 A. emits a radiation which almost coincides with that of the fluorescing I_2; the differences in the spectra presumably are due to an interaction between the active I_2 and SnI_2. The active I_2 is produced in a reaction $SnI_4 \rightarrow SnI_2 + I_2$ and not by recombination of two I atoms since the position of the fluorescing mols. in the tube is identical with that of the absorbing mols., and the intensity of the fluorescence ∝ that of the irradiation (max. at v.p. 0·03 mm.). The heat of activation is 10 kg.-cal. per mol. A quenches the fluorescence < does H_2. BiI_3 behaves like SnI_4. J. J. B.

Electronic transitions in Pr^{+++} ions and the absorption spectra in solution and in crystals. P. C. Mukherji (Indian J. Physics, 1938, **11**, 399—407; cf. A., 1937, I, 393).—The absorption spectra of Pr^{+++} ions in solution and in large single crystals of $PrCl_3,7H_2O$ at room and liquid air temp. were investigated in the region 900—200 mμ. A preliminary classification of the groups of absorption lines and bands is based on the assumption that they are due to inner forbidden transitions. Results are discussed in relation to Van Vleck's theory of the absorption spectra of rare earths (cf. A., 1937, I, 165). N. M. B.

Ultra-violet absorption spectrum of acetylene. A. Ionescu (Bull. Soc. roum. Phys., 1934, **36**, No. 63—64, 151—167; Chem. Zentr., 1936, ii, 56).—Analysis of the fine structure of some of the bands indicates their origin as due to $^1\Sigma—^1\Sigma$ electron transitions. H. N. R.

Ultra-violet absorption of simple hydrocarbons. IV. Unsaturated cyclic hydrocarbons in the Schumann region. (Miss) E. P. Carr and (Miss) H. Stücklen (J. Chem. Physics, 1938, **6**, 55—61).—The vapours of *cyclo*hexene, *cyclo*pentene, $\Delta^{1:3}$-*cyclo*hexadiene, and C_6H_6 have been examined in the region 2300—1600 A. Similarities to the spectra of olefines having the same arrangement of H atoms about the double bond are discussed and it is deduced from this that the electronic excitation responsible for the production of these bands is independent of the cyclic structure of the mol. Characteristic vibrational frequencies and different electronic levels have been identified. W. R. A.

Interaction of some chromophores in the *iso*quinoline series. M. Gerendás, E. Varga, and G. von Fodor (Z. physikal. Chem., 1938, **181**, 315—323).—A no. of arylated acylaminopropanols and *iso*quinoline derivatives have been spectrographically examined with reference to the applicability of Henri's law of additivity. Extinction curves of equimol. mixtures of PhMe with β-acetamido-α-hydroxy-α-3 : 4-methylenedioxyphenylpropane (I), and of PhMe and veratrole with 6 : 7-methylenedioxy-1 : 3-dimethyl*iso*quinoline are not only identical with the curves calc. from the separate curves of the components, but are also identical with the curves of compounds containing the two components in the mol., viz., the β-phenylacetamido-analogue of (I), 6 : 7-methylenedioxy-1-benzyl- and -1-homoveratryl-3-methyl*iso*quinoline, respectively. C. R. H.

Absorption and fluorescence spectra of the colouring matters of litmus and red cabbage. II. I. G. Popescu (Bull. Soc. roum. Phys., 1934, **36**, No. 63—64, 83—95; Chem. Zentr., 1936, ii, 55).—The spectra are described in detail; both types vary considerably with the solvent. Comparison of the spectra shows that the two colouring matters, although not identical, are similar in structure. H. N. R.

Spectral investigation of glucose glass. W. M. Cohn (J. Chem. Physics, 1938, **6**, 65—67).—In the region 3600 to 8000 A. glucose glasses of different thermal history and colour give different transmission curves. The flat transmission max. and the short-λ absorption limit are displaced towards longer λλ with increasing caramelisation. W. R. A.

4·3 μ. Fundamental band in the spectrum of CO_2. D. M. CAMERON and H. H. NIELSEN (Physical Rev., 1938, [ii], **53**, 246—247).—The band due to the fundamental oscillation ν_3 of the mol. has been remeasured and almost completely resolved into its rotational fine structure. An expression is found for the lines, and the convergence factor is —0·0031, agreeing with theory (cf. Adel, A., 1933, 885). N. M. B.

Infra-red absorption studies. IV. Spectrum of water in an inert solvent. L. B. BORST, A. M. BUSWELL, and W. H. RODEBUSH (J. Chem. Physics, 1938, **6**, 61—64).—In the region 2·6—3·8 μ. the absorption spectra of dil. solutions of H_2O, HDO, and D_2O in CCl_4 and in CS_2 are identical. The origin of the bands is discussed. W. R. A.

Alteration in the infra-red absorption spectrum of water in gelatin. J. W. ELLIS and (MISS) J. BATH (J. Chem. Physics, 1938, **6**, 108).—The following absorption spectra are recorded and discussed: (1) a 0·20 mm. layer of gelatin dried to const. wt. at 120°, (2) a portion of (1) which had absorbed 35·7% H_2O and increased in thickness to 0·28 mm., (3) a layer of 0·09 mm. of H_2O, and (4) 0·17 mm. H_2O. (1) can be interpreted in terms of CH and NH vibrations alone. The alterations in the spectra due to the equal increased effective thicknesses are attributed to changes in the spectrum of H_2O due to differences in the structure or in the environment of the H_2O. W. R. A.

Infra-red reflexion spectrum of glasses. F. MATOSSI and H. BLUSCHKE (Z. Physik, 1938, **108**, 295—313).—Infra-red reflexion spectra of 23 glasses and some B compounds are measured over the range 2—26 μ. All Si glasses show two strong characteristic bands at 9 and 22—23 μ. Both these maxima (as in silicates) are ascribed to the active vibration of the SiO_4 tetrahedron. Pb and Ba glasses show a shift of the short-wave band towards longer λλ, increasing with Pb or Ba content, and due to the degree of binding with the SiO_4 tetrahedron. The B glass spectra are due to the sp. frequencies of the plane BO_3 triangle as shown from spectra of B compounds. Results are shown to agree with the crystallite hypothesis for glass structures. L. G. G.

Infra-red absorption spectrum of acetic deuteracid. R. C. HERMAN and R. HOFSTADTER (J. Chem. Physics, 1938, **6**, 110).—AcOD, prepared from AcCl and 99·6% D_2O, has been investigated in the vapour phase from 1 to 15·5 μ.; the H-bonded O–H frequency is shifted from 2·75 to 4·3 μ. The C–H valency frequency is extremely weak. W. R. A.

Infra-red spectra and modes of vibration of benzene derivatives. II. Disubstituted derivatives. J. LECOMTE (J. Phys. Radium, 1938, [vii], 9, 13—26).—The results for the disubstituted derivatives of C_6H_6 (X·C_6H_4·Y, with X and Y = OMe, NH_2, OH, F, Me, CN, Cl, Br, I, NO_2) in the region 500—1400 cm.$^{-1}$ are discussed by the same method as has been applied to the mono-substituted derivatives (A., 1938, I, 117). For each of the positions, *o*-, *m*-, and *p*-, the influence of the substituents on the location of the bands has been studied. W. R. A.

Infra-red absorption of the OH group of phenol. W. GORDY and A. H. NIELSEN (J. Chem. Physics, 1938, **6**, 12—16).—The fundamental vibration band of the OH group of PhOH at approx. 3 μ. has been investigated for solutions containing from 0·23 to 9 mols. per litre in C_6H_6, PhBr, $PhNO_2$, EtOAc, and dioxan. For conc. solutions in all solvents the band appears at the same position, 2·96 μ. In C_6H_6 solution the 9M solution shows only one max. at 2·96 μ., but with more dil. solutions this band diminishes in intensity and at 0·95M another band at slightly shorter λ appears in addition to the 2·96 μ. band, whilst on further dilution to 0·23M the 2·96 μ. band has completely disappeared and only one max. at 2·79 μ. is found. Similar variation occurs for the PhBr solutions. Since neither solvent would be expected to form H bridges with PhOH the shift in the band max. is attributed to the breaking of H bonds between PhOH mols., the 2·96 μ. band being due to associated OH and the 2·79 μ. band to single OH groups. For the oxygenated solvents the variations with dilution are different. Dioxan solutions of all concns. show no measurable shift but this may not indicate association at all concns. since there are independent data indicating that solvents of this type have the property of combining with the solute by H bridges and this would account for the constancy of the band max. In dil. solutions of EtOAc the band is shifted but < in C_6H_6, whilst dil. solutions in $PhNO_2$ show the band shifted to practically the same extent as in C_6H_6. Since the shift observed for phenolic OH is slightly < for alcoholic OH in CCl_4 it is suggested that the bonds between the PhOH mols. are slightly weaker. W. R. A.

Survey of infra-red spectroscopy. II. Origin, appearance, and interpretation of infra-red spectra. R. B. BARNES and L. G. BONNER (J. Chem. Educ., 1938, **15**, 25—39).—The subjects discussed include infra-red spectra of gases, diat. and polyat. mols., linear mols., the symmetric and the asymmetric top, the spectra of crystals, and qual. results of infra-red spectra. (Cf. A., 1938, I, 214.) L. S. T.

Light scattering and other allied physical properties of ordinary and heavy water. S. BHAGAVANTAM and R. S. R. RAO (Proc. Indian Acad. Sci., 1938, **7**, **A**, 35—37).—The adiabatic compressibility and depolarisation of H_2O and D_2O have been measured at room temp. and the isothermal compressibility is calc. from the thermodynamical relation. The relative scattering powers of D_2O and H_2O should be 1·8 : 1 and this is in good agreement with the results obtained with λ 4358 A. F. J. L.

Hydroxyl frequency in the Raman spectra of acids and acid salts. C. S. VENKATESWAREN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 13—20).—The Raman spectra of H_2SO_4 (100% liquid) and crystals of HIO_3, H_2SeO_3, H_6TeO_6, NaH_2PO_4, and $KHSO_4$ have been measured, using the method of complementary filters. In each case a weak diffuse band is recorded of breadth about 2750—3800 cm.$^{-1}$ characteristic of the O–H

vibration but shifted to a lower frequency, due to the presence of H bonds. F. J. L.

Splitting of Rayleigh line and acoustic spectrum of crystals. E. GROSS (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 93—94).—By analogy with results for light diffraction by ultrasonic waves in solids (A., 1935, 1219, 1312; 1936, 277, 673), it is suggested that transverse heat-wave trains, as well as Debye longitudinal waves, affect the Rayleigh scattering. Thus crystals quartz (I), amorphous solids (II), and liquids (III) should show 6, 4, and 2 modified components respectively beside the exciting λ. For (I) and for (III) (A., 1936, 1180) this is so; for (II), experiment is inconclusive. I. McA.

Raman effect and the constitution of zinc iodide and cadmium iodide solutions. (MLLE.) M. L. DELWAULLE, F. FRANÇOIS, and J. WIEMANN (Compt. rend., 1938, **206**, 186—189; cf. A., 1930, 978; 1933, 113).—Raman νν for conc. solutions of ZnI_2 and CdI_2 in H_2O and some simple alcohols, alone and in presence of an alkali iodide, are recorded. Three νν are observed for ZnI_2, and two for CdI_2; the variation of their intensities with [I′] and the ionising power of the solvent indicates that the solutions contain two complex Zn ions, and one complex Cd ion, respectively. A. J. E. W.

Light scattering and fluid viscosity. (SIR) C. V. RAMAN and B. V. R. RAO (Nature, 1938, **141**, 242—243; cf. A., 1937, I, 293).—Fabry–Perot patterns of light scattered by PhOH show that the Doppler-shifted components come increasingly into evidence as temp. is raised. In a non-viscous liquid such as PhMe, both the displaced and the undisplaced components are practically completely polarised with the vibrations parallel. With PhOH, the undisplaced vibration is only partly polarised, as it appears both in the vertical and the horizontal vibrations. The theory which regards the diffusion of light in liquids as due to reflexion of light by regular and infinitely extended trains of sound waves present in them holds only in part for ordinary liquids and breaks down completely for very viscous liquids. L. S. T.

Raman spectra of benzene and isotope effect. H. C. CHENG, C. F. HSUEH, and T. Y. WU (J. Chem. Physics, 1938, **6**, 8—11).—Using a dispersion of 3 A. per mm. the Raman spectrum of C_6H_6 has been measured and the relative intensities of the 992 cm.$^{-1}$ and its weak satellite at 984 cm.$^{-1}$ are 100 : 6. This ratio agrees exactly with the ratio of $^{12}C_6H_6$ to $^{12}C_5{}^{13}C_1H_6$ on the assumption that the relative abundance of ^{12}C to ^{13}C is 100 : 1. PhCl, PhBr, and PhMe give similarly a weak line at approx. 8 cm.$^{-1}$ < their prominent line at about 1000 cm.$^{-1}$ and, although intensity data could not be obtained because of strong background, the magnitude of the frequency difference is taken to indicate a similar origin for the satellite. *cyclo*Hexane has a symmetrical vibration at 800 cm.$^{-1}$ accompanied by a very weak line some 6 cm.$^{-1}$ less but the relative intensities are ≪ 6 : 100. This may mean that *cyclo*hexane is non-planar. An approx. theoretical calculation of the isotopic shift due to the introduction of one ^{13}C for one ^{12}C supports the view that the weak satellite originates from the isotopically-substituted mol. W. R. A.

Vibration spectra and electric moments of azomethane, *NN′*-dimethylhydrazine, and acetaldazine. W. WEST and R. B. KILLINGSWORTH (J. Chem. Physics, 1938, **6**, 1—8).—Electron diffraction measurements on NMe:NMe vapour (A., 1935, 687) eliminated the linear arrangement of C and N and suggested that the *trans* planar model was the best representation of the mol. The Raman spectrum of liquid NMe:NMe at −60° and the infra-red spectrum of the vapour indicate that the mol. has a centre of symmetry and, since the mol. has zero electric moment at 25° in C_7H_{16}, it is concluded that the Me groups are in a *trans* arrangement. The Raman displacement of 1442 cm.$^{-1}$ is ascribed to the N:N linking and an explanation is offered for the numerical difference between this frequency and the frequency of the isolectronic C:O linking. The Raman spectrum of NHMe·NHMe is characteristic of an asymmetrical mol. and in C_7H_{16} its electric moment at 25° is 1·35 D. The asymmetry is in accord with the data of Penney and Sutherland on N_2H_4 (A., 1934, 1158). Possible structures are discussed. Acetaldazine in C_7H_{16} at 25° has an electric moment of 1·16 D., indicating asymmetry. Its strongest Raman line at 1627 cm.$^{-1}$ is assigned to the C:N vibration; its dielectric const. at 25° is 4·435. The depolarisation factors of the strong Raman lines of each compound are given. W. R. A.

Raman effect. LXXX. Nitrogen compounds. 9. Nitriles (dicyanogen and nitriles of unsaturated acids). A. W. REITZ and R. SABATHY (Monatsh., 1938, **71**, 131—143).—Data for liquid C_2N_2, and the nitriles of acrylic, methacrylic, *cis*- and *trans*-crotonic, *iso*crotonic, ββ-dimethylacrylic, and fumaric acids are recorded. Constitutional influences on the CN frequency are discussed. H. J. E.

Raman spectra of mixed crystals. S. C. SIRKAR and I. BISHUI (Indian J. Physics, 1938, **11**, 417—425).—The Raman spectra of *p*-$C_6H_4Cl_2$ and *p*-$C_6H_4Br_2$ were investigated and results are discussed in relation to some divergent data reported by Vuks (cf. A., 1937, I, 497). N. M. B.

Raman spectrum of isocyclic hydrocarbons with condensed nuclei. R. MANZONI-ANSIDEI (Atti R. Accad. Lincei, 1937, [vi], **26**, 166—170, and Gazzetta, 1937, **67**, 790—802; cf., A., 1937, I, 283).—The Raman spectra of solutions of the following hydrocarbons and derivatives have been measured: $C_{10}H_8$, anthracene, phenanthrene, retene, 9 : 10-dihydroanthracene, acenaphthene, fluorene, 1-$C_{10}H_7Cl$, 1- and 2-chloroanthracene. O. J. W.

Colour change in zircon by irradiation. J. LIETZ (Z. Krist., 1937, **97**, 337—353; cf. A., 1937, I, 392).—*K*–λ curves (*K* = absorption coeff.) for colourless Mongka zircon plates show marked absorption in the ultra-violet, the radiation causing luminescence of λ 4800 A., and a grey-brown coloration with bands at 1·90, 2·65, and (3·4) e.v. Spectrophotometric analysis, between 4000 and 7000 A., of the colour fading caused by visible light

(infra-red has no effect) or temp. up to 250°, is recorded. I. McA.

Ultra-violet luminescence of *X*-rayed rock-salt crystals. M. L. KATZ (Physikal. Z. Sovietunion, 1937, **12**, 373—382; cf. A., 1937, I, 10).—Annealed (I), normal, and plastically deformed (II) crystals, exposed to W *X*-rays and then to visible light give similar phosphorescence- and fluorescence-spectra. (I) emit λ 2350 A. only; (II) emit λλ 2350 and 2950 A. The fluorescence bands at 2350, 2950 A. are preferentially excited by the visible λλ 4700, 4900 A., respectively. Crystals not *X*-rayed but excited by an Al spark emit in both spectra only the λ 2350 A. The results are related to the lattice energy levels of Hilsch and Pohl (A., 1935, 9, 808). I. McA.

Mechanism of propagation of electronic excitation energy, and photosynthesis in plants. J. WEISS (Nature, 1938, **141**, 248—249).—A mechanism for the propagation of electronic excitation energy in a complex of mols. is suggested from considerations on the quenching of fluorescence of dyes in solution. The mechanism may be applicable to the process of assimilation by green plants. L. S. T.

Cathode luminescence of luminescent calcium silicate. E. IWASE and S. IIMORI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 173—181).—The yellow cathode luminescence of wollastonite and pectolite is also shown by artificial $CaSiO_3$ containing traces of Mn, whereas other impurities cause a blue luminescence. The presence of Mn in the natural minerals is confirmed analytically. F. J. G.

Quenching of fluorescence in solution by foreign substances. II. Influence of the solvent on the quenching. B. J. SVESCHNIKOV (J. Phys. Chem. Russ., 1937, **10**, 654—660).—The quenching of the fluorescence of fluorescein by KI in aq. glycerol and sugar solutions, and of rhoduline-red by NH_2Ph in various alcohols appears to be a function of the viscosity of the solvent only, whilst that of rhodamine-B by NH_2Ph in 20 solvents shows 7 exceptions. The quenching of the fluorescence of uranine by NH_2Ph in various alcohols at various temp. is a function of η/T only. J. J. B.

[Proof of the carrier laws for the mercury-vapour rectifier.] B. KLARFELD (Physikal. Z. Sovietunion, 1937, **11**, 669—671).—The experimental methods of von Engel *et al.* (A., 1937, I, 104) are criticised. A. J. M.

Galena light detector. F. FISCHER, B. GUDDEN, and M. TREU (Physikal. Z., 1938, **39**, 127—134).—The existence of a spontaneous photo-potential at various PbS point contacts on illumination has been shown. There is also a thermo-electric effect. The effects of temp. on the photo-effect, the spectral distribution of the photo-current for various specimens of PbS, and the effect of pressure of the contact on the photo-effect were investigated. A. J. M.

Vectorial photo-electric effect in barrier-layer cells. R. G. WILSON (Physical Rev., 1938, [ii], **53**, 264).—The light absorbed by a Weston photronic barrier-layer cell was greater, and the cell response was greater, when the electric vector was in the plane of incidence than when it was perpendicular to the plane. The differences are small and results are mainly qual. N. M. B.

Negative photo-conductivity in polycrystalline cuprous oxide. P. G. BORZIAK (Physikal. Z. Sovietunion, 1937, **12**, 482—484).—When the Cu electrode is negative, white and green light cause a decrease, red light an increase, in the conductivity of Cu_2O cells at liquid air temp. I. McA.

Maximum photo-potentials for the crystal photo-effect with cuprite. A. DEMBER (Rev. Fac. Sci. Istanbul, 1937, **3**, 50—63).—Determinations of photo-potential, photo-current, and conductivity of natural Cu_2O crystals indicate that in addition to that part of the crystal which takes part in providing the photo-potential there is a considerable area, varying with the arrangement of the electrodes, which acts as a shunt. This is largely a surface effect as it is affected by the H_2O content of the atm. With an illumination of $1{\cdot}44 \times 10^6$ Lux, photo-potentials of 0·268, 0·310, and 0·416 v. were reached, these vals. being considerably in excess of the saturation val. given by the electron diffusion theory (0·20 v.). A. J. M.

Solid friction in dielectric losses. A. GEMANT (Trans. Faraday Soc., 1938, **34**, 269—274).—Theoretical. Formulæ for the low-frequency dielectric const. and loss of angle are derived. A quant. explanation of the experimental solid friction law is given on the basis of the imperfect structure of solids. E. S. H.

[Dielectric] breakdown of compressed nitrogen in small gaps. I. M. GOLDMAN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 89—92).—For gaps of 50, 100, 200, 1000 μ. between a steel sphere (d 2 cm.) and a plane brass disc, crit. p.d. (V)–pressure (p) and crit. field (X)–p curves are determined for p in the range 0—110 kg. per sq. cm. For a given p, V increases with gap but X decreases. For a given gap, V, X, increase with p to saturation vals. (V_s, X_s). p_s increases with gap. As dielectric, compressed N_2 is preferable to a vac., as X_s varies from 1450 to 1000 kv. per cm. and may be increased by ~10% on using an Al disc. I. McA.

Electrical behaviour of thin metallic films condensed at low temperatures. H. R. MITCHELL (Physical Rev., 1938, [ii], **53**, 250—256).—The resistance of a Zn film condensed in high vac. on a polished quartz plate cooled with liquid N_2 decreased irreversibly with rising temp., but decreased slowly at a const. temp. above the deposition temp. Results for Cd were similar, but the effect of thickness was more apparent and the resistance changed by a larger factor. If the deposition surface is of similar metal (Zn on Zn, or Zn on Cd) the temp.–resistance relation is influenced, but if of a dissimilar metal (Zn on Ag) this is not the case. Results favour the assumption that agglomeration and crystallisation are responsible for the changes in resistance. N. M. B.

Ionic conductivity in thin films of NaCl. J. BOROS (Z. Physik, 1938, **108**, 162—167).—Films of NaCl, 0·2—2·5 μ. thick, produced by evaporation, have a much enhanced sp. electrical conductivity

both in the plane of the film and at right angles to it. Conductivities in the two directions are different functions of film thickness. H. C. G.

Conductivity of thin metallic films according to the electron theory of metals. K. FUCHS (Proc. Camb. Phil. Soc., 1938, **34**, 100—108).—Theoretical deductions of the conductivity of thin metallic films with (*a*) random scattering of electrons at the surface, (*b*) partially elastic scattering. The experimental results for Cs are compared with the theoretical vals. F. J. L.

Calculation of the effect of residual inductances in high-frequency capacitance measurements. J. G. MILLER (J. Amer. Chem. Soc., 1938, **60**, 42—46).—The effects of residual inductances are analysed. A method, based on parallel substitution measurements made at varying frequency and const. total capacitance, is proposed for calculating the true val. of the capacitance of a cell used in measuring the dielectric const. of liquids of low conductance. E. S. H.

Dipole moments of unsaturated compounds. II. M. GORMAN, R. M. DAVIS, and P. M. GROSS (Physikal. Z., 1938, **39**, 181—185).—The dipole moments of $CPh_2{:}CMe_2$, C_2H_3Ph, β-bromostyrene (I) (high- and low-m.p. isomerides), and $CPh{:}CI$ in C_6H_6 and CCl_4 have been determined. The assumption that the CH group adjacent to a double or triple linking has a group moment of which the positive end is directed towards the C atom, and not, as in the case of aliphatic CH groups, towards the H, has been found to apply in the above cases. Assuming the correctness of this, the configurations of the two isomerides of (I) are deduced. A. J. M.

Dielectric constants of ω-hydroxydecanoic acid polymerides. J. WYMAN, jun. (J. Amer. Chem. Soc., 1938, **60**, 328—329).—Polarisation measurements of the polymerides of average mol. wt. 1715—28,650 show no anomalous dispersion up to frequencies of $4{\cdot}8 \times 10^7$ cycles per sec. The polarisation per g. is independent of the size of the polymeride and can be calc. on the assumption that the polarisation of each mol. is the sum of the polarisations of the polar groups contained. It appears that, owing to free rotation about the intervening C·C linkings, each polar group orients in the field without restriction from the rest of the mol. E. S. H.

Comparison of dielectric properties of starch and cellulose triacetates and those of benzene solutions of tribenzylcellulose and cellulose tripalmitate. I. SAKURADA and S. LEE (Kolloid-Z., 1938, **82**, 67—72; cf. A., 1935, 1319).—The dipole moments of starch and cellulose triacetates are identical at any temp. between 10° and 50°, whence it is inferred that the val. of this const. is a property of the glucose unit and independent of both the nature of the glucoside linkage and the degree of polymerisation. The mol. polarisation of starch triacetate and of cellulose tripalmitate is independent of concn., whilst that of tribenzylcellulose decreases with increase of concn. F. L. U.

Dependence on temperature of dipole moments of cellulose, cellobiose, and glucose acetates. S. LEE and I. SAKURADA (Kolloid-Z., 1938, **82**, 72—75).—Vals. of ε in the range 20—50° are given for C_6H_6 or $CHCl_3$ solutions of fully acetylated glucose, cellobiose, and cellulose. The dipole moments in $CHCl_3$ solution at 20° and 50°, respectively, referred to 1 glucose unit, are: β-glucose penta-acetate 2·256, 2·400; α-cellobiose octa-acetate 1·957, 2·18; cellulose triacetate 1·761, 1·93, all $\times 10^{-18}$. The increase of ε with rising temp. in all three is attributed to hindrance of the free rotation of the Ac groups. F. L. U.

Dependence of double refraction of crystals on temperature. F. K. DRESCHER-KADEN, S. HELLER, and VAN LOOK (Naturwiss., 1938, **26**, 105—106).—A self-recording apparatus for the determination of the effect of temp. on double refraction, using a photo-cell and cathode-ray tube, is described. A. J. M.

Rotatory power of mixtures of ascorbic acid and sodium hydroxide.—See A., 1938, II, 124.

Electrical Kerr effect and state of order in liquid and gaseous carbon dioxide. L. H. BORCHERT (Physikal. Z., 1938, **39**, 156—166).—The Kerr effect has been determined for liquid and gaseous CO_2, the results for the gas above the crit. temp. agreeing with the Langevin–Born orientation theory up to the crit. density. The results for liquid CO_2 in the neighbourhood of the crit. point also deviate comparatively slightly from the Langevin theory. With increasing density and decreasing temp. the deviations in both the gaseous and liquid state are greater. This is due to denser packing and the consequent anisotropy of the internal field. The deviations in the neighbourhood of the crit. point indicate the existence of complex formation of the type $\overset{-}{O}—\overset{++}{C}—\overset{-}{O}$ $\quad$ $\overset{-}{O}—\overset{++}{C}—\overset{-}{O}$ in agreement with other physical properties of CO_2. A. J. M.

Diamagnetic polarisability of the benzene molecule. H. KÖNIG (Z. Physik, 1938, **108**, 391—394).—From measurements of the Cotton–Mouton const. in C_6H_6 vapour, the diamagnetic polarisability is calc. and vals. for magnetic anisotropy are compared with those on liquid C_6H_6 of other authors. Discrepancies are ascribed to association and intermol. action generally. L. G. G.

Birefringence of an atomically stratified medium. J. WEIGLE (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 137—140).—Mathematical. L. S. T.

Magnetic birefringence of aromatic compounds in the molten state. W. J. JOHN (Trans. Faraday Soc., 1938, **34**, 275—278).—Data are recorded for C_6H_6, p-$C_6H_4Cl_2$, p-$C_6H_4Br_2$, Ph_2, $(CH_2Ph)_2$, salol, $COPh_2$, diphenylene oxide, and $C_{10}H_8$. The variation of the vals. with the no. of C_6 rings in the mol. is in accordance with the rule of Chinchalkar and Mahajan (A., 1936, 271, 1447). E. S. H.

Magnetic double refraction of organic liquids and their vapours. H. KÖNIG (Ann. Physik, 1938, [v], **31**, 289—314).—The magnetic double refraction of C_6H_6 vapour has been measured at pressures from

1 to 4·5 atm. and temp. from 90° to 150°. The Cotton–Mouton const. has mean val. $2·5 \times 10^{-15}\pm$ 6% at 90° and 760 mm. The mol. Cotton–Mouton const., which is so defined as to be, at a given temp., independent of density and refractive index, is, for C_6H_6 vapour, 2·04 times that of the liquid. The variation of the const. with temp. is discussed. Results are interpreted on the basis of the orientation theory. The magnetic double refraction of $PhNO_2$ vapour is very small and the mol. Cotton–Mouton const. is < that of the liquid. O. D. S.

Constitution of the nitrosopentamminecobalt salts. (MRS.) J. L. MILWARD, W. WARDLAW, and W. J. R. WAY (J.C.S., 1938, 233—236; cf. Sidgwick and Bailey, A., 1934, 833).—The black compound $[5NH_3CoNO]Cl_2,0·5H_2O$ is paramagnetic with Weiss magneton no. 8·32, whilst the red compound $[5NH_3CoNO](NO_3)_2,0·5H_2O$ is diamagnetic. It is probable that the red series of nitrosopentamminecobalt salts are true nitroso-derivatives with formula $[NO\text{-}Co.5NH_3]X_2$ whilst the black series have a structure in which the NO group resonates, giving rise to the two forms:

$[5NH_3,\overset{\cdot\cdot}{\underset{\cdot\cdot}{Co}}—\overset{+}{N}\equiv\overset{+}{O}]X_2$ and $[5NH_3,\overset{-}{Co}=\overset{+}{N}=O]X_2$.

O. D. S.

Resonance and mesomerism. C. K. INGOLD (Nature, 1938, **141**, 314—318).—An outline of the theory, and its application to some examples. L. S. T.

Interatomic distances in simple polyatomic molecules. G. B. B. M. SUTHERLAND (Trans. Faraday Soc., 1938, **34**, 325—335).—Vals. for interat. distances in Me halides derived from a crit. re-examination of available spectroscopic data are: C—F 1·385±0·004, C—Cl 1·66±0·05, C—Br 1·88± 0·08, C—I 2·07±0·16 A. These vals. are < those obtained by the electron-diffraction method. Comparison of the force consts. characteristic of the C–halogen linking in these mols. with those in the C tetrahalides shows that the C–halogen distance is increased in the tetrahalides, again in disagreement with electron-diffraction results. The dimensions of the Me group appear hardly to vary in passing from MeF to MeI. E. S. H.

Predissociation of isotopic molecules. E. OLSSON (Z. Physik, 1938, **108**, 322—325).—Theoretical. According to classical calculations, the boundary curves for predissociation of isotopic mols. should correspond, but this is not confirmed experimentally (AlH/AlD). Deviations from equality are in agreement with the quantum mechanical formula of Kronig (A., 1930, 981). L. G. G.

Bond force constants and vibrations of tetramethylmethane and tetramethylsilicon. F. T. WALL and C. R. EDDY (J. Chem. Physics, 1938, **6**, 107).—Calculations by means of a rigorous and an approx. method are in good agreement with observed vals. of frequencies. W. R. A.

Internal free rotation in hydrocarbons. G. B. KISTIAKOWSKY and E. B. WILSON, jun. (J. Amer. Chem. Soc., 1938, **60**, 494—495).—Polemical (cf. A., 1938, I, 71). Preponderant evidence is for strongly hindered rotation. E. S. H.

Separate regions of science and practice. Remarks on atomic volume curve. W. KLEMM (Chem.-Ztg., 1938, **62**, 97—100).—A discussion of the at. vols. of the elements in the light of modern views on electronic structure. L. S. T.

Units in chemico-physical and physico-chemical units. K. BUTKOV (Physikal. Z. Sovietunion, 1937, **12**, 485—488).—Textual errata are cited and a plea is made for dimensional precision. I. McA.

Van der Waals forces between symmetrical rotators. K. G. CARROLL (Physical Rev., 1938, [ii], **53**, 310—312).—Mathematical. The calculations of Margenau (cf. A., 1937, I, 349) on the first-order perturbation energy between symmetrical top mols. is extended to the second-order perturbation to the Van der Waals forces. Results show that this effect is negligible in line broadening. N. M. B.

Dissociation scheme of some metallic hydrides. R. SCHMID and L. GERÖ (Naturwiss., 1938, **26**, 108).—In the spectra of many metallic hydrides there are Σ terms which are difficult to place in present dissociation schemes. If the scheme of term combinations is started lower these difficulties disappear, and all dissociation phenomena indicated by the spectra of hydrides and deuterides of elements in the second and third columns of the periodic table can be explained. A. J. M.

Quantum theory of LiH^+. G. S. GORDADSE (Physikal. Z. Sovietunion, 1937, **12**, 426—434; cf. Knipp, A., 1936, 781).—An application both of previous mathematical technique (A., 1936, 667) and of the Heitler–London method shows the system to be unstable. I. McA.

Potential energy curve of the excited state of LiH. E. J. ROSENBAUM (J. Chem. Physics, 1938, **6**, 16—18).—Mathematical. W. R. A.

Intermolecular coupling of the second type in liquids. A. PIEKARA (Z. Physik, 1938, **108**, 395—400).—Theoretical. L. G. G.

Kinetic theory and electrical properties of liquids. J. I. FRENKEL (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 287—327).—The effects of heat motion and mol. rotation in liquids, binary and dipole crystals on distant and local order is discussed. A theory of orientational fusion (disappearance of ordered orientation of the mols. while their centres of gravity remain regularly distributed) and fusion (disappearance of distant order and retention of local order) is put forward. The electrical conductivity of ionic crystals is due entirely to the most mobile ion, and viscosity to the least. Debye's theories of the dielectric losses in glasses containing a small no. of metallic ions, dipole liquids, and crystals are criticised. F. J. L.

Absorption and dispersion in paramagnetic crystals under alternating magnetic fields. R. DE L. KRONIG (Physica, 1938, **5**, 65—80).—Theory previously developed (cf. A., 1937, I, 20) is extended in the light of new data for paramagnetic alums in high-frequency fields. N. M. B.

Probability of transference of vibrational energy on collision of carbon dioxide molecules

with molecules of admixed gases. I. M. METTER (Physikal. Z. Sovietunion, 1937, **12**, 233—234).—The effect of dipole moment and the chemical relationship of the admixed gas to CO_2 on the transference of vibrational energy on collision between mols. was investigated by examining the dispersion of supersonic waves in CO_2 mixed with H_2O vapour, CO, NO, and N_2. Chemical relationship between admixed gases and CO_2 is the deciding factor in the probability of energy exchange. The decrease in the probability is parallel to the heat evolved in the possible reactions between CO_2 and the admixed gases. A. J. M.

Determination of the range of the forces between the lattice units in homopolar crystals from the form of crystal growth. I. N. STRANSKI (Z. physikal. Chem., 1938, **B**, **38**, 451—460).—An apparatus for measuring the rate of growth of a single crystal of Cd from the gas phase is described. The application of such measurements to the determination of interat. forces in the cryst. lattice is discussed. H. J. E.

Approximate quantum-mechanical treatment of the electrons in a crystalline lattice. O. KLEIN (J. Phys. Radium, 1938, [vii], **9**, 1—12).—Mathematical. The integration of the Schrödinger equation for a periodic field of force in one dimension is discussed, leading to an approx. determination of the Brillouin zones. Another form of the equation is discussed whereby the problem is reduced from one of three dimensions to one of one dimension. The method is applied to the problem of interaction of electrons in the cryst. lattice. W. R. A.

Extension of the Macleod equation. D. T. LEWIS (J.C.S., 1938, 261—264).—Theoretical. It is suggested that the Macleod const. is a function of crit. temp. A linear relation exists, for compounds of similar constitution, between the parachor and the crit. temp., b.p., and molal heat of vaporisation. Deviations from this rule are ascribed to association. O. D. S.

Parachor of hexamethylenetetramine (urotropine). T. C. HUANG, M. Y. PEÑG, K. S. HU, and P. P. T. SAH (J. Amer. Chem. Soc., 1938, **60**, 489).—The val. determined in aq. solution at 20—45° is 315·2. E. S. H.

Calculation of dimensions of micelles of thread-like substances from the interference of *X*-rays refracted at smallest angles. O. KRATKY (Naturwiss., 1938, **26**, 94).—When a bundle of cellulose threads is irradiated with *X*-rays a diffuse interference is found near the centre. The mean size of the micelle can be calc. from determinations of intensity within this interference area. A. J. M.

Conditions at the limits in the problems of diffraction by periodic media. J. PATRY and J. WEIGLE (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 140—142).—Theoretical. L. S. T.

Bragg reflexion on a medium disturbed by ultra-sound. R. EXTERMANN and J. WEIGLE (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 142—144).—Theoretical. L. S. T.

Scattering of *X*-rays by crystals in the neighbourhood of the Curie point. L. LANDAU (Physikal. Z. Sovietunion, 1937, **12**, 123—137).—Theoretical. Expressions for the coherent and incoherent scattering of *X*-rays at crystals near the Curie temp. are derived. The effect of temp. on the intensity of the scattering was calc., and the intensity distribution in the spots of the Laue diagram and the rings of the Debye–Scherrer diagram was determined. A. J. M.

Non-characteristic white and black lines in *X*-ray spectra obtained by diffraction in crystals. (MLLE.) Y. CAUCHOIS and H. HULUBEI (Compt. rend., 1938, **206**, 181—184).—The formation by reflexion of certain lines characteristic of the crystal grating, and independent of the nature of the anticathode, is discussed. A. J. E. W.

Indirect excitation and exclusion rules [in *X*-ray crystal analysis]. E. BRANDENBERGER (Z. Krist., 1937, **97**, 476—484).—Theoretical. Lattice-structural, metrical, and physical factors are involved in the simulation of forbidden reflexions by indirect excitation (Renninger, A., 1937, I, 117, 446). This phenomenon may affect the validity of zonal and serial space-group criteria, but not of those of translation groups. Conditions for its occurrence are analysed and procedure is given for its recognition; it may be avoided by the use of fine-grained powder. I. McA.

***X*-Ray determination of grain-size in metal foil.** A. KOCHENDÖRFER (Z. Krist., 1937, **97**, 469—475).—Approx. theory developed for a thin ribbon foil of small extent, examined by the Debye–Scherrer method, is applied in the Laue expression to yield a formula giving the width of a diffraction line as a function of grain-size, width of ribbon, angle of incidence of *X*-ray beam, reflecting plane, and apparatus and other consts. Theory, tested on powdered Fe, confirmed results by Brill's method to 2%. Concordant results averaging 23, 22, and 18 mμ. respectively were obtained from the fractured edges of scrap Cu, Cu–Ni, and Cu–Ag foil. I. McA.

Effect of temperature on the atomic distribution in liquid sodium. F. H. TRIMBLE and N. S. GINGRICH (Physical Rev., 1938, [ii], **53**, 278—281).—*X*-Ray diffraction patterns of liquid Na were obtained at eight temp. in the range 100—400° with monochromatic Mo $K\alpha$ radiation, and at. distribution functions were obtained by Fourier analysis of the 100° and 400° intensity curves. At 400° the first concn. of atoms about any atom occurs at a distance of 3·90 A., and the second at about 7·2 A. At 100° the distance of closest approach of the atoms is 3·83 A. N. M. B.

Nucleus formation in recrystallisation. VI. Dependence of the rate of nucleus formation on the temperature. M. KORNFELD and V. PAVLOV (Physikal. Z. Sovietunion, 1937, **12**, 301—306; cf. A., 1937, I, 349).—An Al wire was glowed for 2 hr. at 420°, deformed by extension, allowed to relax at 320° for 20 hr., and the nuclei on recryst. were studied. The log of the velocity of nuclear formation is not a linear function of $1/T$. R. S. B.

Existence of crystallisation nuclei above the f.p. and the structure of liquids. V. DANILOV and V. NEUMARK (Physikal. Z. Sovietunion, 1937, **12**,

313—323).—The relation between the supercooling of H_2O, Hg, Bi, and Sn and the previous temp. of heating has been studied; it could not be correlated with structural changes in the liquid as revealed by *X*-rays. R. S. B.

Rontgenographic investigation of simple liquids and double liquid systems. V. I. DANILOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 377—378).—The co-ordination of atoms in liquid Pb and Bi is due to the same forces which exist in the solid state. Eutectic aq. NaCl and LiCl at −15° to −20°, and the eutectic alloys Bi–Pb and Bi–Sb, have been examined and regions with the structure of each of the components have been found. F. J. L.

Crystallisation of supercooled sulphur in a magnetic field. V. V. KONDOGURI (Physikal. Z. Sovietunion, 1937, **11**, 571—575).—A magnetic field applied parallel to a layer of supercooled S increases the no. of crystallisation centres. A field perpendicular to the layer decreases the no. The curve between temp. and no. of crystallisation centres is completely altered when the magnetic field is applied, the max. and min. occurring at different temp. The effect was most marked with thinnest layers (0·02 mm.). A. J. M.

Mosaic structure of rock-salt. D. B. GOGOBERIDSE (Physikal. Z. Sovietunion, 1937, **11**, 621—626).—The mosaic structure of rock-salt has been investigated by *X*-rays. It is due to the formation of layers which are rotated with respect to each other. The phenomenon of asterism was observed with thick crystals with wide clefts. A. J. M.

Anode dendrites in crystals of alkali halides. S. ARZIBISCHEV and B. VESKER (Physikal. Z. Sovietunion, 1937, **11**, 627—635).—Easily fusible metals form liquid dendrites when placed in rock-salt or artificial sylvine and heated (600—740°) and made the anode in electrolysis of the crystal. The dendrites are described in the case of Pb, Mg, Te, Sb, Bi, Sn, Th, Cd, Al, Mn, and Cu. Ag, Au, Be, Sr, Se, and Ca gave no dendrites. In the case of Te and Bi the dendrites consisted of metallic particles oriented in a definite manner in the crystal. The effect of *U* and *F* electrons on the dendrite formation is examined. The presence of *U* centres had no effect on the formation of dendrites with Pb, but *F* centres accelerated their formation with Pb, and retarded it with Te. A. J. M.

Structure of germanous iodide. H. M. POWELL and F. M. BREWER (J.C.S., 1938, 197—198).—A modified method of preparing GeI_2 is described. The crystal structure is of the *C*.6 type, and the radius of the $Ge^{"}$ ion for the NaCl type of structure is estimated to be 0·98 A. O. D. S.

$BaCdCl_4,4H_2O$ and its suggested isomorphism with $BaPt(CN)_4,4H_2O$. F. M. QUODLING and D. P. MELLOR (Z. Krist., 1937, **97**, 522—523; cf. A., 1937, I, 173).—$BaCdCl_4,4H_2O$ is not isomorphous with the monoclinic $BaM(CN)_4,4H_2O$ (M = Pt, Pd, or Ni); otherwise square-co-ordinated $[CdCl_4]^{"}$ is implied; twinning by reflexion in (010) occurs. The triclinic nature of the former, determined by crystallographic and *X*-ray data, is confirmed optically; differences in habit, cleavage, and double refraction are marked. I. McA.

Crystals of $CuSO_4,5D_2O$ and $CaSO_4,2D_2O$. P. P. BUDNIKOV and L. S. PALATNIK (J. Phys. Chem. Russ., 1937, **10**, 719—724).—The *X*-ray patterns of $CuSO_4,5D_2O$ and $CuSO_4,5H_2O$, and of $CaSO_4,2D_2O$ and $CaSO_4,2H_2O$, are identical. $CaSO_4,2D_2O$ loses water at 107° more rapidly than $CaSO_4,2H_2O$. J. J. B.

Lattice constants of alums with heavy and light water of crystallisation. E. SAUR (Z. Krist., 1937, **97**, 523—525).—In disagreement with Ernst for the selenates, powder *X*-radiograms show that complete D_2O–H_2O substitution has no effect on the lattice consts. for $KCr(SeO_4)_2,12H_2O$ and $UO_2(NO_3)_2,6H_2O$ (to ~0·1%), and for $KCr(SO_4)_2,12H_2O$ and $KAl(SO_4)_2,12H_2O$ (to 0·03%). This does not imply that the H_2O and D_2O mols. are equidistant from the metal atoms. I. McA.

Migration of foreign ions in crystals of alkali halides. S. A. ARZIBISCHEV (Physikal. Z. Sovietunion, 1937, **11**, 636—646).—The mechanism of dendrite formation at the anode in electrolytic experiments with rock-salt and sylvine (see above) is considered. The mechanism of movement of ions through the crystal lattice, the latter remaining undistorted, is also considered. A. J. M.

Anhydrous ferric silicate. S. E. STERZEL and J. LINDÉN (Jernkont. Ann., 1937, **121**, 660—661).—Debye–Scherrer diagrams of the product formed by heating Fe_2SiO_4 in O_2 at 900° and 1300° showed the presence of Fe_2O_3 and SiO_2, but not Fe^{III} silicate. M. H. M. A.

***X*-Ray analysis of the structure of glasses.** A. A. LEBEDEV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 381—389).—The view that the crystallites in vitreous SiO_2 are either cristobalite or tridymite is supported; the size is of the order of 10—12 A. depending on the mode of prep. and heat-treatment. Soda glass (23% Na_2O) heated to 300° and then allowed to cool shows linear residual changes in refractive index at temp. corresponding with the transformations of cristobalite and tridymite. F. J. L.

Structure of silica glass by *X*-ray diffraction studies. B. E. WARREN and J. BISCOE (J. Amer. Ceram. Soc., 1938, **21**, 49—54).—The random network theory of the glassy structure is consistent with the experimental facts that (1) the Fourier analysis indicates that each Si is tetrahedrally surrounded by 4 O and each O is shared between 2 Si, (2) the absence of small-angle scattering indicates the absence of discrete particles which accounts for the liquid-like continuity of structure, (3) the pattern can be explained by the presence of cristobalite crystals only if they are smaller than 8 A. and distorted. J. A. S.

***X*-Ray investigation of crystals of *p*-aminobenzoic acid. Space-group.** M. PRASAD, M. R. KAPADIA, and V. C. THAKAR (J. Indian Chem. Soc., 1937, **14**, 667—669).—Recorded data are: *a* 12·26, *b* 8·61, *c* 6·30 A., space-group C_{2h}^5. E. S. H.

Structure of aromatic compounds. II. Benzil. K. BANERJEE and K. L. SINHA (Indian J. Physics, 1938, **11**, 409—415).—The space-groups of the two enantiomorphic crystal forms are $D_3^4C_{3_1}2$ and $D_3^6C_{3_2}2$. The mol. plane of each mol. is inclined to the triad axis at 13°; the three mols. are parallel to the three basal axes and are arranged spirally about a threefold screw-axis. N. M. B.

Liquid-crystalline and solid forms of ethyl *p*-anisylideneaminocinnamate, $C_{19}H_{19}O_3N$. D. VORLÄNDER, R. WILKE, H. HEMPEL, U. HABERLAND, and J. FISCHER (Z. Krist., 1937, **97**, 485—503; cf. A., 1933, 1107, 1108; 1937, I, 403).—Two cryst. (*S*) and three liquid-cryst. (*C*) forms exist. The scheme: Liquid $\overset{139°}{\rightleftharpoons} C_{\text{I}} \overset{118°}{\rightleftharpoons} C_{\text{II}} \overset{91°}{\rightleftharpoons} C_{\text{III}} \overset{84°}{\rightleftharpoons} S_{\text{I}} \rightarrow S_{\text{II}}$ and $C_{\text{III}} \rightarrow S_{\text{II}} \overset{106°}{\longrightarrow} C_{\text{II}}$ is confirmed (in reply to criticism) by careful prep. and measurements of d, η, and particularly of optical properties, varying temp. and conditions of specimen. C_{III} may be unnoticed in thin layers. I. McA.

X-Ray adventures among the proteins. W. T. ASTBURY (Trans. Faraday Soc., 1938, **34**, 378—388).—A lecture. E. S. H.

X-Ray studies of the action of sodium sulphide on cellulose. I. SAKURADA and J. MATUSITA (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1437—1441).—The X-ray diagram of cellulose is unaltered by the action of 15 wt.-% aq. Na_2S at room temp. With 18·5 wt.-% Na_2S (saturated solution) the diagram corresponds with that of a mixture of Na-cellulose I and natural cellulose. On washing the product of the action of Na_2S with EtOH the mixture changes to Na-cellulose III′ and cellulose, and on washing with H_2O to hydrated and natural cellulose. Cellulose hydrate with 18·5 wt.-% Na_2S gives Na-cellulose I. R. S. B.

Structure of macromolecules of caoutchouc and cellulose. H. STAUDINGER (Chem.-Ztg., 1938, **62**, 117—119).—A lecture. F. L. U.

Crystal structure of cellulose and rubber. H. MARK and K. H. MEYER (Z. physikal. Chem., 1938, **B**, **38**, 395—399).—A reply to criticisms by Sauter (cf. A., 1937, I, 554). H. J. E.

Determination of molecular structure of the vapours of zinc iodide and cadmium iodide by electron diffraction. O. HASSEL and L. C. STRÖMME (Z. physikal. Chem., 1938, **B**, **38**, 466—468).—The mols. are linear and symmetrical, with the interat. distances: Zn—I, $2{\cdot}42_3 \pm 0{\cdot}02$, Cd—I $= 2{\cdot}59_6 \pm 0{\cdot}02$ A. H. J. E.

Electron-diffraction investigation of the molecular structures of keten and thiophosphoryl chloride. J. Y. BEACH and D. P. STEVENSON (J. Chem. Physics, 1938, **6**, 75—80).—Electron diffraction photographs of gaseous keten and $PSCl_3$ have been interpreted both by the visual and by the radial distribution methods. For keten, by assuming a C—H distance of 1·07 A. and the tetrahedral angle, the distances C—C (1·35 A.) and C—O (1·17 A.) have been calc. For $PSCl_3$ the following vals. are given: P—Cl = 2·01 A.; P—S = 1·94 A.; angle Cl–P–Cl = 107°. The results are discussed in terms of covalent radii and the resonance of mols. among several electronic structures. W. R. A.

Electron-diffraction investigation of the molecular structures of *iso*butane, *tert.*-butyl chloride, and *tert.*-butyl bromide. J. Y. BEACH and D. P. STEVENSON (J. Amer. Chem. Soc., 1938, **60**, 475—481).—The C–C–C angles for *iso*-C_4H_{10}, $Bu^{\gamma}Cl$, and $Bu^{\gamma}Br$, respectively, are 113° 30′±2°, 111° 30′±2°, and 111° 30′±2°. Interat. distances are: C—C 1·54±0·02, C—Cl 1·78±0·03, C—Br 1·92±0·03 A. The steric repulsions between H and halogen have been calc. and compared with electrostatic interactions. E. S. H.

Electron-optical image of the cathode in a gaseous discharge. H. MAHL (Ann. Physik, [v], **31**, 425—442).—Conditions are discussed for the production of a clear image when the object in an electron microscope is a metal cathode excited by bombardment with positive ions from a gaseous discharge within the microscope. Clear images are obtained with an auxiliary magnetic field at a lower discharge potential than in the absence of field. O. D. S.

Limit of the resolving power of the electron microscope. M. VON ARDENNE (Z. Physik, 1938, **108**, 338—352).—The effect on resolution of diffraction at the object, of the influence of space charge on the path of the radiation, of error at the objective diaphragm, of chromatic radiation due to electron velocity distribution at the source, of scattering at the object, and of stray magnetic fields is discussed critically. L. G. G.

Electron-optical observation of the transition of α- into β-zirconium. W. G. BURGERS and J. J. A. PLOOS VAN AMSTEL (Nature, 1938, **141**, 330).—Photographs of electron-emission patterns of α-Zr at a cathode temp. of 600°, and of β-Zr at 1100° show that, as in the case of martensite, a Widmannstätten texture is exhibited by α-crystallites formed from the β-phase. On retransformation into the β-state, the original crystallites reappear. This behaviour, which differs from crystal growth observed on transition of α- to γ-Fe, confirms the conclusion, deduced from X-ray investigation, that the change α- to β-Zr is brought about by a homogeneous transformation (shearing combined with dilatation) of coherent lattice regions parallel to definite crystallographic planes and directions. L. S. T.

Second or Gaussian approximation in the Heisenberg theory of ferromagnetism when $S > \frac{1}{2}$. J. H. VAN VLECK (J. Chem. Physics, 1938, **6**, 105—106).—Mathematical. W. R. A.

Magnetic quality of iron wire as influenced by the diameter. T. F. WALL (Nature, 1938, **141**, 205—206).—Data for Armco wire indicate that (i) there is one diameter for which permeability is a max. and that permeability decreases rapidly as the diameter changes from the crit. val., (ii) there is a surface layer of the wire which is magnetically harder than the core, and has a dominating effect on the magnetic quality of wires of small diameter, and (iii) by suitably coating the wire and heat-treating, the magnetic quality can be controlled over a wide range. Ni wire also has a crit. diameter. L. S. T.

Magnetic hysteresis in [silicon steel] single crystals. R. JAANUS and J. SCHUR (Physikal. Z. Sovietunion, 1937, **12**, 383—388).—The coercivity of single-crystal discs from cold-worked transformer sheet is anisotropic. For directions in (100) it varies between 0·1 and 0·2 oersted, is a max. along [010], and disobeys the Ruder formula (A., 1935, 687).

I. McA.

Magnetic properties of nickel and nickel-rich alloys. T. HIRONE (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1409—1418).—The magnetic properties of Ni and solid solutions of Ni and other elements are discussed on the basis of Bloch's and Slater's theories. R. S. B.

Magnetic interaction in (A) homogeneously strained ferromagnetic crystals, (B) pyrrhotite and magnetite. L. W. MCKEEHAN (Physical Rev., 1938, [ii], **53**, 301—307, 307—309; cf. A., 1937, I, 503).—(A) Mathematical. Akulov's method of computing magneto-strains as the strains necessary to minimise the sum of magnetic and elastic potential energies is improved in detail, extended to include terms dependent on the structure of at. magnets, and applied to the cases of body-centred cubic Fe, face-centred cubic Ni, and hexagonal close-packed Co.

(B) Magnetic potential energy densities, including quadrupole terms, have been computed for important directions of magnetisation in pyrrhotite and magnetite. In the former, results disagree with experiment, indicating the predominance of other causes of ferromagnetic anisotropy; in the latter, results suggest that all the Fe atoms contribute to the ferromagnetism, and there is qual. agreement with experiment. N. M. B.

Magnetostriction due to quadrupole energy of ferromagnetic substances. T. HIRONE (Sci. Rep. Tôhoku, 1937, **26**, 282—296).—Mathematical. The quadrupole energy of elementary magnetic elements in ferromagnetic substances is related to the size of the elements and to the lattice const. The magnetostriction of these substances cannot be explained on the basis of the dipolar and quadrupolar energies.

J. W. S.

Growth of magnetic reversal nuclei for large Barkhausen discontinuities. W. DÖRING (Z. Physik, 1938, **108**, 137—152; cf. A., 1935, 1310).—Theoretical difficulties in the interpretation of Sixtus' work (cf. A., 1933, 15, 216, 768) are overcome by consideration of the surface energy at the boundary between opposed magnetic circuits. Evaluation of this energy from Sixtus' results gives $\gamma = 2{\cdot}7$, in good agreement with Bloch's theoretical val. H. C. G.

Elastic properties of solids of high mol. wt. H. DOSTAL (Monatsh., 1938, **71**, 144—152).—Theoretical. Modifications in the theory of elasticity are introduced on account of the η of the system and the vol. occupied by the mols. H. J. E.

Nature of coercive force and irreversible changes in magnetisation. E. KONDORSKI (Physikal. Z. Sovietunion, 1937, **11**, 597—620).—Bloch's theory (Z. Physik, 1932, **74**, 295) that irreversible changes of magnetisation are due to displacement of boundaries between regions of spontaneous magnetisation has been extended by assuming that the position and equilibrium of the boundaries are determined by min. magnetic energy and the elastic energy due to magnetostriction of the boundary layer. These assumptions make it possible to calculate the coercive force as a function of the width of the boundaries, the gradients of the internal stresses, and the direction of spin in relation to the field. The decrease of coercive force on extension of substances with positive magnetostriction is also explained. The dependence of remanence and of coercive force on intensity of field under different tensions is calc. and agrees well with experiment.

A. J. M.

Amorphous condition. Elasticity of amorphous bodies. P. P. KOBEKO, E. V. KUVSCHINSKI, and G. I. GUREVITSCH (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 329—344).—Complete mechanical deformation of amorphous bodies is composed of resilient initial, resilient high elastic, and non-resilient plastic deformations, proceeding independently. Heating causes high elastic deformation to set in earlier. Rubber and ebonite are highly elastic at all temp.; the hardening with decreasing temp. proceeds gradually. F. J. L.

Determination of elasticity constants. F. KHOL (Z. Physik, 1938, **108**, 225—231).—A dynamic method is described whereby the elasticity modulus and Poisson's const. may be determined from the radial vibration of circular plates. Measurements with tourmaline, quartz, and Ni are recorded. With Ni the variation of the two consts. with temp. was investigated. H. C. G.

Theory of crystal plasticity. A. KOOHENDÖRFER (Z. Physik, 1938, **108**, 244—264).—A comprehensive discussion of the mechanism of crystal formation and deformation. H. C. G.

Two experiments on strength [of crystals]. A. V. STEPANOV (Physikal. Z. Sovietunion, 1937, **12**, 182—190).—Two experiments are described which show that the low val. of the practical strength of rock-salt crystals is due to plastic deformation. For crystals which, under ordinary conditions, have a rupturing strength of 500 g. per sq. mm., the strength could be increased to 2000 g. per sq. mm. when plastic deformation was eliminated, and decreased to 80 g. per sq. mm. when such deformation was favoured.

A. J. M.

Effect of a groove on the strength of single crystals of rock-salt. I. Effect of a rectangular groove. A. V. STEPANOV (Physikal. Z. Sovietunion, 1937, **12**, 191—214).—Plastic deformation of rock-salt crystals on applying tension can be hindered by cutting a deep groove [for which height (h)/diameter (d) $\ll 1$] in the crystal. The strength of the crystal can thus be considerably increased (*e.g.* four-fold); this increase is not due alone to the decrease in the plastic deformation. For a given d the strength is the higher the smaller is h, and for a given h, the strength first increases with decreasing d, and then decreases. Annealing the crystal and scratching its surface did not alter the effect of grooving. The effect of temp. and erosion of the crystal by dissolution

on the strength of the grooved crystals was determined. A. J. M.

Influence of a groove on the strength of rock-salt. II. Inclined groove. A. V. STEPANOV (Physikal. Z. Sovietunion, 1937, **12**, 343—359).—Single-crystal prisms are given lateral sawcuts of varying type, depth, and inclination (α) to the prism axis [100], along which tension is applied. Smooth fracture usually occurs in the full cross-section in a cube plane. The dependence of limiting strength on temp., "neck" cross-section, α, and surface erosion is determined. Results are interpreted through plastic deformation. I. McA.

Solidity and consolidation of rock-salt. W. SCHMIDT (Z. angew. Min., 1937, **1**, 1—29).—The behaviour of different samples of powdered NaCl under pressuro has been investigated. Flow curves are recorded and discussed. The marked increase of resistance to flow shown by NaCl during the course of deformation is of considerable tectonic and technical importance. L. S. T.

α–γ Transformation of iron and its alloys. J. MARTELLY (Ann. Physique, 1938, [xi], **9**, 318—333).—Investigations on pure Fe and on Fe–Pt show that the transformation, indicated by a discontinuity in the magnetisation–temp. curve, is irreversible. For Fe, the γ–α is 13° lower than the α–γ transformation and this divergence is usually greater in the case of alloys. The diagrams for Fe–Pt and Fe–Ru aro analogous with those of Fe–Ni. The γ–α transformation temp. decreases rapidly with the proportion of added metal and approaches 0° K. so closely that the α-phase exists only for $<$ 25 at.-% Pt or 15 at.-% Ru. N. M. B.

Change in resistance of single crystals of aluminium in strong magnetic fields at low temperatures. E. JUSTI and H. SCHEFFERS (Physikal. Z., 1938, **39**, 105—109).—The electrical resistance of pure Al single crystals at 78°, 64°, 20°, 14°, and 4·3° K. in magnetic fields up to 35 KG. was determined. Only a small anisotropy of the resistance increase is shown in a transverse magnetic field. A longitudinal effect was also observed at 20° K., which is $<$ one third of the transverse effect. For const. field the increase in the transverse resistance is a max. at a definite temp. (for 18·7 KG., 40° K.). At const. low temp. the transverse resistance increase is delayed as the field strength increases. The effect of deformation, impurities, and mosaic structure is investigated. A. J. M.

Resistance of selenium at high field strengths. F. P. HENNIGER (Ann. Physik, 1938, [v], **31**, 337—364).—The resistance of Se has been measured by a single spark method at potentials from 0·1 to 110 kv. and temp. from 20° to 90°. R decreases markedly with increasing V, and from 5 to 60 kv. decreases linearly with log V. The effect of V varies with previous treatment of the Se and is due, largely, to the existence of both external and internal boundary layers. At the highest V, the sp. resistance is about 500 ohms per cm., $\ll$ than previously recorded vals. The effect of temp. decreases with increasing V, and the effect of V decreases with increasing temp. Results are confirmed by measurements of the resistance of Se barrier-layer rectifiers in the direction of flow. O. D. S.

Magnetic properties of tellurium on colloidalisation. M. PRASAD and S. S. DHARMATTI (Indian J. Physics, 1938, **11**, 393—398; cf. A., 1937, I, 292).—The effect on magnetic susceptibility of powdering for various periods, powdering under paraffin, fusing, and washing the powders with cold dil. HCl was investigated. Results show that particle size has no bearing on susceptibility changes. As the time taken for powdering in air for the same period is increased, the diamagnetic susceptibility decreases and the powders become paramagnetic, indicating that the change is due to impurities formed by the absorption or adsorption of gases giving rise to complex oxides sol. in HCl. In all cases the powders regain the bulk val. after frequent washing. N. M. B.

Magnetic anisotropy in ferromagnetic crystals in weak fields. E. KONDORSKY (Physical Rev., 1938, [ii], **53**, 319—320; cf. Williams, A., 1938, I, 18).—A theoretical discussion based on recent experimental data. N. M. B.

Magnetochemical studies. XXVIII. Magnetic behaviour of the allotropic modifications of manganous sulphide. F. MEHMED and H. HARALDSEN (Z. anorg. Chem., 1938, **235**, 193—200).—χ has been measured for the three forms over a range of temp. $\mu_{\text{eff.}}$ is always $<$ calc. for the $Mn^{\cdot\cdot}$ ion, but approaches this val. with rising temp. F. J. G.

Diamagnetic anisotropy of ring-shaped molecules. J. FRENKEL and V. SAVELIEV (Physikal. Z. Sovietunion, 1937, **12**, 435—457; cf. A., 1933, 10; 1937, I, 20, 397).—A comprehensive wave-mechanical treatment. Assuming free electrons, expressions are derived for the diamagnetic susceptibility ($\chi_\perp$ only) of a plane at. ring (i) at 0° K., and (ii) as a function of temp. (i), calc. without perturbation theory and with due regard to electron energy distribution in the field, confirms Pauling's formula (*ibid.*, 20). The main component of (ii) decreases with increasing temp., in accord with Krishnan's data for graphite (*ibid.*, 174). With multi-electron rings at high temp., the ring characteristics disappear and the electrons behave as in metals. If electron interaction is assumed, the stability of an electron chain is greater, and χ varies less with temp. The bearing of the results on the theory of metals, particularly in relation to superconductivity, is stressed. I. McA.

Coupling between the orbital and the spin angular momenta of paramagnetic ions from magnetic measurements. K. S. KRISHNAN and A. BOSE (Nature, 1938, **141**, 329).—The magnetic anisotropies of $NiSO_4,6H_2O$ and $NiSeO_4,6H_2O$ have been measured at room temp. and at the temp. of liquid O_2. The anisotropy at −183° is approx. 4·8 times that at 23°. From this ratio the spin-orbit coupling const. in Ni^{++} is calc. to be −331 $cm.^{-1}$, in agreement with the val. −335 $cm.^{-1}$ obtained from spectroscopic data. L. S. T.

Magnetic anisotropy of naturally occurring substances. III. Wood and its constituents.

P. NILAKANTAN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 38—49).—The diamagnetic anisotropy and abs. susceptibilities of wood, lignin, and wood cellulose have been measured. The hemicelluloses and lignin make no contribution to the magnetic anisotropy, suggesting that they are either amorphous or, if cryst., arranged at random. The max. diamagnetic susceptibility and electric polarisibility in the cellulose mol. appear to be along the length of the chain.

F. J. L.

Propagation of sound in gases. H. L. SAXTON (J. Chem. Physics, 1938, **6**, 30—36).—Mathematical. A general energy equation is derived for wave propagation in a pure gas of any no. of energy states, taking into account viscosity and heat conduction, and is first solved for a single two-state gas and then extended to mixtures of gases, including air.

W. R. A.

Dispersion of ultrasonic waves in liquids. A. K. DUTTA (Physikal. Z., 1938, **39**, 186—187).—The velocity of ultrasonic waves in H_2O, decalin, and xylene compared with that in PhMe has been determined with waves of frequency $10^6 - 3 \times 10^7$ Hz. There is no dispersion in decalin and xylene, but a marked dispersion in H_2O, due to the complicated structure and aggregation of H_2O mols. A. J. M.

Propagation of supersonic waves in liquids. I. Dispersion in some pure liquids and aqueous solutions. II. Dispersion in acetic acid. B. G. SCHPAKOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 169—172, 173—175).—I. An absence of a marked dispersion in a no. of liquids, *e.g.*, amyl acetate, EtOAc, EtBr, was observed when the velocities of progagation of supersonic waves throughout a wide range of frequencies were measured. The velocities of propagation of supersonic waves in saturated solutions of KBr and KI are diminished by increasing the frequency.

II. The velocity of propagation of supersonic waves in AcOH for a wide range of frequencies has been measured by the method of the ultra-acoustic interferometer. The explanation of the dispersion of supersound in AcOH probably lies in the existence in AcOH solutions of simple and double mols. of AcOH.

W. R. A.

Heat capacity of diamond from 70° to 300° abs. K. S. PITZER (J. Chem. Physics, 1938, **6**, 68—70).—The deviations between the observed vals. of the sp. heat of diamond over the temp. range 70—300° K. and those calc. from the theoretical formula of Debye are discussed. The entropy at 298·1° K. is 0·585 ± 0·005 mg.-cal. per degree per mol. W. R. A.

Heat capacity of water and water vapour along saturation lines. D. I. SHURAVLEV (J. Phys. Chem. Russ., 1937, **10**, 452—454).—Vals. for 20—350° have been calc. from existing data. The sp. heat of the saturated vapour is negative throughout and is a max. at ~220°. The thermal capacities of the saturated vapour at 20°, 120°, 220°, and 320° are $-1{\cdot}549_6$, $-0{\cdot}995_7$, $-0{\cdot}846_5$, and $-1{\cdot}276_1$, respectively, the corresponding vals. for the liquid (C_p) being $0{\cdot}998_6$, $1{\cdot}015_0$, $1{\cdot}101_9$, and $1{\cdot}574_1$ g.-cal. per degree, respectively. R. C.

Entropies of nitrogen tetroxide and nitrogen dioxide. Heat capacity from 15° K. to the b.p. Heat of vaporisation and vapour pressure. The equilibria $N_2O_4 = 2NO_2 = 2NO + O_2$. W. F. GIAUQUE and J. D. KEMP (J. Chem. Physics, 1938, **6**, 40—52).—Heat capacity data are recorded from 15° to 294° K. N_2O_4 has m.p. 261·90° K., b.p. 294·25° K., heats of fusion and evaporation respectively 3502 and 9110 g.-cal. per mol., v.p. (261·90° to 294·9° K.) $\log_{10} P$ (int. cm. Hg) $= -(1753{\cdot}000/T) + 8{\cdot}00436 - 11{\cdot}8078 \times 10^{-4} T + 2{\cdot}0954 \times 10^{-6} T^2$, and v.p. (240·3° to 261·90° K.) $\log_{10} P = -(2460{\cdot}000/T) + 9{\cdot}58149 + 7{\cdot}6170 \times 10^{-3} T - 1{\cdot}51335 \times 10^{-5} T^2$. The entropy of gaseous N_2O_4 at the b.p., at which it is dissociated 16·1%, is 80·62 g.-cal. per degree per mol. By combining this entropy val. with available equilibria data on $N_2O_4 = 2NO_2 = 2NO + O_2$ and with spectroscopic data on the various substances several thermodynamic quantities have been evaluated. The vals. of $S^\circ_{298\cdot1}$ for gaseous N_2O_4 and NO_2 are respectively 72·73 and 57·47 g.-cal. per degree per mol., but these do not include the nuclear spin entropy of N atoms and this correction, amounting to $R \log_e 3 = 2{\cdot}183$ for each N atom, must be added, yielding for the abs. vals. of $S^\circ_{298\cdot1}$ 77·10 and 59·65 g.-cal. per deg. per mol. Vals. (in parentheses after the reaction) respectively of $\Delta G^\circ_{298\cdot1}$ and $\Delta H^\circ_{298\cdot1}$ in g.-cal. have been obtained for the following reactions: $2NO_2 = N_2O_4$ (−1110; −13,693), $N_2 + 2O_2 = N_2O_4$ (23,440; 2239), $NO + \frac{1}{2}O_2 = NO_2$ (−8375; −13,562), $\frac{1}{2}N + O_2 = NO_2$ (12,275; 7964). Correlation of various measurements on the above equilibria has been made and the good agreement demonstrates that the entropy val. obtained from the experimental measurements and the third law of thermodynamics is correct. On the assumption that NO_2 is a symmetrical non-linear mol. the statistical wt. of the normal electronic state as calc. from equilibria data is 2, in agreement with existing magnetic data. The entropy val. suggests that N_2O_4 is a symmetrical mol. and that the NO_2 groups are incapable of free rotation. W. R. A.

Low-temperature heat capacity of gaseous ethane. G. B. KISTIAKOWSKY and F. NAZMI (J. Chem. Physics, 1938, **6**, 18—24).—The heat capacity of C_2H_6, measured at approx. 140° K. by Eucken and Weigert (A., 1934, 20) using a "hot wire" method, levelled off at low temp. to a val. considerably $>3R$, indicating that the Me groups were capable of free rotation. Existing evidence against this view is considered and further it is rendered doubtful by measurements of the heat capacity at 163° and 143° K. with a modified form of the hot wire method.

W. R. A.

Specific heat of complex compounds and their molecular structure. P. N. PAVLOV [with L. M. SERTSCHEL] (J. Gen. Chem. Russ., 1937, **7**, 2442—2447).—The formula given is $Mq/\omega = 5{\cdot}6(1 + a/\omega)$, where M is mol. wt., q sp. heat, ω the transformation coeff., characterising association of the mols., and a is the no. of "internal kinetic units" of the mol., characterising the no. of degrees of freedom of its atoms; $a = 1$, $\frac{2}{3}$, or $\frac{1}{3}$, when the atom has 3, 2, or 1 degrees of freedom, respectively. The vals. of a found

suggest that the atoms of a complex mol. may be bound electrostatically or by covalency, or that both types of binding may coexist in the same mol.

R. T.

Thermodynamic functions of the chloro- and bromo-methanes, formaldehyde, and phosgene. D. P. STEVENSON and J. Y. BEACH (J. Chem. Physics, 1938, **6**, 25—29, 108).—Fundamental vibration frequencies from infra-red and Raman spectra combined with moments of inertia calc. from electron diffraction data are used to calculate certain thermodynamic functions of eight halogenomethanes, $COCl_2$, and CH_2O by use of the harmonic oscillator–rigid rotator approximation over the temp. ranges for which the approximation is valid. Entropies for the compounds at 298·1° K. are recorded; equilibrium data on $CO + Cl_2 = COCl_2$ are not sufficiently accurate to permit calculation of S_{COCl_2}. By utilising existing data on free energy functions and thermochemical data, the free energy of formation of chloromethanes, $COCl_2$, and CH_2O have been calc. C_p for bromomethanes, $COCl_2$, and CH_2O have been calc. for various temp. W. R. A.

Adiabatic demagnetisation of cæsium titanium alum. J. H. VAN VLECK (J. Chem. Physics, 1938, **6**, 81—86).—Mathematical. W. R. A.

Experiments establishing the thermodynamic temperature scale below 1° K. Magnetic and thermodynamic properties of gadolinium phosphomolybdate as a function of field and temperature. W. F. GIAUQUE and D. P. MACDOUGALL (J. Amer. Chem. Soc., 1938, **60**, 376—388).—$Gd(PMo_{12}O_{40}),30H_2O$ has been demagnetised adiabatically to reach temp. $<1°$ K. Adiabatic differential susceptibilities have been measured up to fields of 8000 gauss and down to 0·13° K. The measurements form the basis of experimental procedure for determining the intensity of magnetisation as a function of field. $Gd(PMo_{12}O_{40}),30H_2O$ is an ideal paramagnetic substance at temp. $>1°$ K. The thermodynamic properties, intensity of magnetisation, differential susceptibility, energy and heat content have been tabulated as functions of magnetic field and temp. Thermodynamic temp. have been determined in the region made available by the magnetic cooling method. The thermodynamic scale agrees with the temp. predicted by Curie's law down to 0·15° K. The energy change during isothermal magnetisation at 1·4° K. is practically zero.

E. S. H.

International Bureau of Physico-chemical Standards. VIII. Physical constants of twenty organic compounds. J. TIMMERMANS and [MME.] HENNANT-ROLAND (J. Chim. phys., 1937, **34**, 693—739; cf. A., 1936, 20, 149).—The following data for b.p./760 mm., m.p., and d_4^{15} (or at temp. stated) have been determined: *cyclo*pentane 49·30°, —95·0°, 0·75033; methyl*cyclo*pentane 72·00°, —139·2°, 0·75343; *cyclo*pentanol 140·85°, —, 0·95078; 1-methyl*cyclo*pentanol —, —, 0·90652 (36°); methyl-*cyclo*pentene 75·85°, —123·35°, 0·78452; *cyclo*pentanone 130·65°, —51·3°, 0·95353; *cyclo*hexanol 161·10°, 25·15°, 0·94155 (30°); *cyclo*hexanone 155·65°, —16·4°, 0·95099; EtCl 12·30°, —136·4°, 0·90280; $1\text{-}C_{10}H_7Br$ —, 6·10°, 1·48834; $(CH_2\cdot CN)_2$ —, 57·2°, 0·98669 (60°); PhOH 182·20°, 40·75°, 1·05446 (45°); *m*-cresol 202·70°, 11·95°, 1·03803; $p\text{-}C_6H_4Me\cdot NH_2$ 200·55°, 43·75°, 0·96589 (45°); $p\text{-}C_6H_4Me\cdot NO_2$ 238·50°, 51·65°, 1·12259 (55°); $(CH_3)_2O$ 10·7°, —111·7°, 0·89713 (0°); 1:4-dioxan 101·40°, 11·80°, 1·03916; C_5H_5N 115·50°, —41·8°, 0·98783; piperidine 106·40°, —10·5°, 0·86591; quinoline 237·10°, —15·6°, 1·09771. V.p., coeffs. of dilatation, refractive indices, viscosities, and surface tensions are also given. F. L. U.

Structure and thermodynamic properties of long-chain compounds. I. Lattice energy of normal paraffins. II. Pre-melting in the solid–liquid transition of octadecane. A. R. UBBELOHDE (Trans. Faraday Soc., 1938, **34**, 282—292, 292—299).—I. Data are recorded for (1) the v.p. of solid $n\text{-}C_{14}H_{30}$, $n\text{-}C_{16}H_{34}$, $(C_6H_{13})_2CO$, and $C_7H_{15}\cdot CO\cdot C_6H_{13}$, (2) v.p. equations and latent heats of vaporisation of liquid $n\text{-}C_{14}H_{30}$, $n\text{-}C_{15}H_{32}$, $n\text{-}C_{16}H_{34}$, $n\text{-}C_{17}H_{36}$, $n\text{-}C_{18}H_{38}$, cetene, $n\text{-}C_7H_{15}\cdot CO\cdot C_6H_{13}$, $n\text{-}(C_7H_{15})_2CO$, $n\text{-}(C_8H_{17})_2CO$ at 430—480° K., (3) sp. heats and latent heats of transformation or fusion of $C_{14}H_{30}$, $C_{15}H_{32}$, $C_{16}H_{34}$, and cetene, and (4) the vol. change of $C_{14}H_{30}$ on solidification and on being heated from the m.p. to 140°. From these and other data, vals. for the lattice energy of $C_{14}H_{30}$, $C_{15}H_{32}$, $C_{16}H_{34}$, $C_{18}H_{38}$, cetene, and $(C_6H_{13})_2CO$ are derived. The val. for the tilted structure of paraffins is about $1{\cdot}29 \times 10^{-13}$ erg per CH_2 group, and for the vertical structure about $1{\cdot}05 \times 10^{-13}$ erg per CH_2, and is lowered by the double linking in cetene and raised by the dipole in $(C_6H_{13})_2CO$.

II. The phenomenon has been investigated by determining the sp. heat of $C_{18}H_{38}$ above and below the m.p., determining the purity of samples by *X*-ray analysis, and by determining the influence of $n\text{-}C_{14}H_{30}$, $\text{-}C_{16}H_{34}$, and $\text{-}C_{22}H_{40}$, respectively, on the m.p. and setting point. Marked pre-melting is observed at least 15° < the setting point in samples of $C_{18}H_{38}$ containing $<1\%$ of neighbouring paraffins. The effect appears to be a definite process occurring within the solid phase in the neighbourhood of the m.p. Pre-melting may lead to flaws in a crystal in thermodynamic equilibrium at temp. < the m.p.

E. S. H.

Determination of vapour pressure of tantalum and niobium chlorides. M. A. OPICHTINA and N. A. FLEISCHER (J. Gen. Chem. Russ., 1937, 7, 2016—2021).—The v.p. of $TaCl_5$ rises from 2·1 mm. at 120° to 698 mm. at 230°, and of $NbCl_5$ from 0·74 mm. at 100° to 590 mm. at 230°. R. T.

Density and pressure of aniline vapour at low temperatures. V. G. GUREVITSCH and K. K. SIGALOVSKAJA (J. Gen. Chem. Russ., 1937, 7, 1805—1808).—The v.p. of NH_2Ph rises from 0·707 at 0° to 2·85 mm. at 49·9°, and the *d* of the saturated vapour from 0·386 at 0° to 13·2 mg. per litre at 49·9°.

R. T.

Statistical mechanics of condensing systems. III. J. E. MAYER and S. F. HARRISON. **IV.** S. F. HARRISON and J. E. MAYER (J. Chem. Physics, 1938, **6**, 87—100, 101—104).—III. Mathematical. A general development of the Gibbs phase integral for a system of chemically saturated mols. gives equa-

tions for the thermodynamic properties of the system.

IV. From the above theoretical equations it can be predicted that, in a finite density and temp. range above the temp. of disappearance of the meniscus, a range of microscopic densities is equally stable, and in a sealed bomb different densities may be observed at a given temp. and average density. The vals. of the densities in various parts of the bomb may be predicted from a knowledge of the previous history, in agreement with the results of Maass on systems near the crit. point. W. R. A.

Equilibrium in superconductors. N. Felici (Compt. rend., 1938, **206**, 242—244).—Theoretical. A. J. E. W.

Validity of Nernst's heat theorem at the absolute zero. H. Schmolke (Z. Physik, 1938, **108**, 183—188).—It is argued that Nernst's original heat theorem remains valid at 0° K. H. C. G.

Influence of magnetic fields on thermal conductivity of gases. Variation with temperature. E. Rieger (Ann. Physik, 1938, [v], **31**, 453—472; cf. Senftleben and Pietzner, A., 1933, 559).—The influence of magnetic field on the thermal conductivity of O_2 and O_2–He mixtures has been measured at field strengths, H, up to 4000 gauss, temp., T, 200° to 780° K., and pressure, p, 20 to 100 mm. For O_2 the effect is a function of $H/p(1 + C/T)$ where C is a const. At low p deviations from this equation are observed, but are explained as due to the dependence of conductivity on the mean free path of the gas mols. O. D. S.

Liquid He II. A. Michels, A. Bijl, and J. de Boer (Physica, 1938, **5**, 121—124).—It is suggested that the abnormally high heat conductivity of He II (cf. Keesom, A., 1936, 788) may be due to mols. carrying an energy > the average energy being able to move through the lattice without exchanging momentum or energy with the other mols. The possibility of this mechanism is deduced from the wave equation, and abnormal velocity of flow is discussed. N. M. B.

New phenomena connected with heat flow in helium II. J. F. Allen and H. Jones (Nature, 1938, **141**, 243—244; cf. A., 1937, I, 453).—Experiments which show that associated with a flow of heat in He II there is a pressure operative in the reverse direction to the heat flow are reported. Under suitable conditions this effect can be utilised to form a liquid He pump. An explanation of the effect is suggested. L. S. T.

Quantum properties of fluidity. L. D. Landau (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 379—380).—Theoretical. F. J. L.

Molecular viscosity. S. I. Vavilov (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 345—357).—The relation between the effective mol. radius and the viscosity is discussed. F. J. L.

Viscosity and electroconductivity of fused salts and glasses. K. S. Evstropiev (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 359—375).—The changes in the viscosity and electroconductivity of liquids, associated liquids, and fused salts with temp. are investigated. For liquid conductors of type II the relation $\chi^n.\eta$ = const. is found experimentally. (Cf. Johnston, A., 1909, ii, 854.) F. J. L.

Viscosity of monolayers : theory of the surface slit viscosimeter. W. D. Harkins and J. G. Kirkwood (J. Chem. Physics, 1938, **6**, 53).—In previous work (A., 1937, I, 454) on the measurement of the η of monolayers by the surface slit viscosimeter no account was taken of the η of the H_2O carried along with the film. The formula previously used has been extended to include this effect. W. R. A.

Joule–Thomson effect in mixtures of helium and nitrogen. J. R. Roebuck and H. Osterberg (J. Amer. Chem. Soc., 1938, **60**, 341—351).—Data for the variation of the Joule–Thomson coeff. with pressure (1—200 atm.), temp. (−100° to 250°), and composition of the mixture are recorded. E. S. H.

Water molecules in active solvents. G. Bosschieter, J. Errera, and R. Gaspart (Physica, 1938, **5**, 115—120).—Transmission curves in the ν range 2900—3700 cm.$^{-1}$ for the liquid mixtures $COMe_2$–H_2O and C_5H_5N–H_2O are given and discussed. Results for $COMe_2$–H_2O are similar to those for dioxan–H_2O (cf. A., 1937, I, 598). Solvents containing O atoms give rise to a double band at 3500 cm.$^{-1}$ corresponding with a single H_2O mol., but in solvents containing N there is a single band displaced to lower ν. This is illustrated by the curve for an equimol. dioxan–C_5H_5N mixture, which shows both bands. N. M. B.

Viscosity of binary mixtures. A. J. A. van der Wyk (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 133—136).—A discussion (cf. A., 1937, I, 72). The η of a binary mixture can be described as a function of its composition only on the condition that in addition to η_1 and η_2, the viscosities of the components, a third const. $\eta_{1,2}$, the "binary viscosity," which has the same dimensions as the viscosity, is introduced. L. S. T.

Fluidities and volume changes of binary systems *iso*propyl alcohol–benzene and *iso*propyl alcohol–water. A. L. Olsen and E. R. Washburn (J. Physical Chem., 1938, **42**, 275—281; cf. A., 1937, I, 295).—The results for 25° are shown in tables and curves, and are discussed from the point of view of Raoult's law. F. L. U.

Equilibria in solutions. V. Certain properties of solutions of ethyl chloride in petrol. S. I. Kaplan, Z. D. Monachova, A. S. Reformatzkaja, and E. I. Bessonova (J. Appl. Chem. Russ., 1937, **10**, 2022—2028).—Solubility, b.p., composition of the vapour phase, and v.p. data are recorded for the system EtCl–petrol. R. T.

Calculation for a binary mixture of the partial vapour pressure from the total pressure. C. G. Boissonnas (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 131—133). L. S. T.

Density of iodine solutions. J. A. Fialkov and A. B. Polistschuk (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 321—327).—The d in the system KI–I_2 passes through a max. for 18 mol.-% KI. In the system PI_3–I_2 there are min. at 17 and 66 mol.-% PI_3 and a max. at 28 mol.-% PI_3. H. J. E.

Inner friction of the systems iodine–iodides of potassium, thallium, phosphorus. J. A. FIALKOV and A. A. KUSMENKO (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 309—320).—Measurements at 130° are recorded. The η (in poises) increases from 0·0172 for I_2 to 0·0391 for 22·67 mol.-% of KI in I_2. For 27·07 mol.-% TlI in I_2 it is 0·0568. These are the solubility limits. The system PI_3–I_2 has been studied up to 100% PI_3. H. J. E.

Isomorphous relationships of some analogous organic derivatives of oxygen, sulphur, and selenium.—See A., 1938, II, 118.

System magnesium–cadmium. K. RIEDERER (Z. Metallk., 1937, **29**, 423—426).—The existence of the compounds $MgCd_2$, formed by prolonged annealing just below the m.p., and $MgCd_3$, MgCd, and Mg_3Cd formed by reactions in the solid state, is confirmed by *X*-ray examination. $MgCd_2$ has a hexagonal structure resembling that of Mg but not close-packed; the other phases have hexagonal lattices with superstructure, but that of MgCd is distorted rhombically. The cast Cd-rich α-phase shows no change in the c/a ratio with increasing Mg content, but filings taken from the alloys show a steady decrease in this ratio with increase in Mg content; *i.e.*, the α-phase is metastable and should be replaced by α′ in the stable equilibrium diagram. A. R. P.

(A) Fusion diagram of magnesium–cadmium alloys. (B) Velocity of transformation of magnesium–cadmium alloys in the region of the compound Mg_3Cd. (C) Velocity of formation of the compound $MgCd_3$ from solid solutions of magnesium in cadmium. N. I. STEPANOV and I. I. KORNILOV (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 67—77, 79—95, 97—112).—(A) The fusion diagram consists of two branches, intersecting at a point corresponding with the compound MgCd, which undergoes polymorphic transformation at 249°.

(B) The velocity of dissociation of Mg_3Cd in alloys into its elements is at a max. at 200° for alloys containing 75 at.-% Mg, as is shown by the rate of fall in conductivity of the alloys; the temp. coeff. of conductivity is also a max. for the same compound. The relations are reversed for the rate of formation of the compound in chilled alloys heated at 100°.

(C) Analogous results are obtained for $MgCd_3$ as for Mg_3Cd. R. T.

Physico-chemical study of the system aluminium–magnesium. I, II. N. S. KURNAKOV and V. I. MICHEEVA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 5—35, 37—66).—I. Resistance, temp. coeff. of resistance, thermal e.m.f., hardness, and micro-structure data confirm the existence of a β- (35·5—37·5% Mg) and a γ-phase (49·5—57·5% Mg). The max. and min. on the curves cannot be related with certainty to any Mg–Al compound.

II. M.p. data afford evidence of the formation of four phases in the region of the m.p.: α 0—15, β 35·3—37·7, γ 41·5—59·4, and δ 90—100% Mg. Compound formation is doubtful, but the γ-phase may possibly contain a dissociated compound, the composition of which cannot, however, be determined from the available data. R. T.

System gold–mercury. I. N. PLAKSIN (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 129—159).—M.p., micro-structure, and *X*-ray data confirm the existence of the compound $AuHg_2$, which undergoes polymorphic transformation at −36° and 122°, and dissociates at 310°, to give Hg and Au_2Hg. This decomposes at 402° to yield Au_3Hg, and this in turn dissociates to Hg and Au at 420°. Solid solutions of Hg in Au have a limiting concn. of 16·7 at.-% Hg. R. T.

System gallium–indium. S. J. FRENCH, D. J. SAUNDERS, and G. W. INGLE (J. Physical Chem., 1938, **42**, 265—274).—M.p.–composition data are given. The eutectic temp. is 16°, 76±0·5% Ga. The solid solution range for Ga in In extends to 9·5% Ga and for In in Ga to <1%. F. L. U.

Thermomagnetic study of silver–cadmium and copper–cadmium systems. N. PERAKIS and L. CAPATOS (J. Phys. Radium, 1938, [vii], **9**, 27—36).—The at. diamagnetism of bivalent Cd ($\chi_A = -15{\cdot}0 \times 10^{-6}$) has been obtained from Cd tetrapyridine persulphate, $(Cd,4C_5H_5N)S_2O_8$. Thermomagnetic study of the complexes Ag–Cd and Cu–Cd tetrapyridine persulphate $[Ag_x(Cu_x)Cd_y,4C_5H_5N]S_2O_8$ between room temp. and that of liquid air shows that they obey Weiss' law over a wide range of concn. Frequent displacements of the Curie point with mixtures of low Cu and Ag content have been observed. Curves of the moment and of the Curie point against concn. are similar for the two systems. The moments of bi- and ter-valent Ag and Cu ions are recorded and their significance is discussed. W. R. A.

Solid solubility at low temperature of silicon or copper in aluminium, and of aluminium in magnesium. M. I. ZACHAROVA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 113—118).—The solid solubility of Al in Mg rises from 2% at 150° to 6·2% at 300°, that of Si in Al from 0·11% at 20—240° to 0·43% at 445°, and of Cu in Al from 0·2% at 20—218° to 0·6% at 300°. R. T.

***X*-Ray investigation of the system Cr–CrAs.** H. NOWOTNY and O. ÅRSTAD (Z. physikal. Chem., 1938, **B**, **38**, 461—465).—The phases Cr_2As (*a* 3·613, *c* 6·333 A.) and CrAs (*a* 3·479, *b* 6·210, *c* 5·730 A.), isomorphous with Fe_2As and FeAs, respectively, are indicated. CrAs and Cr_2As are weakly ferromagnetic. H. J. E.

Magnetic properties and atomic ionisation in an alloy. Study of certain silicides. G. FOËX (J. Phys. Radium, 1938, [vii], **9**, 37—43).—The magnetic properties of alloys have been investigated in order to calculate the magnetic moment using Langevin's formula. Application of the Bose–Stoner theory gives the relation between the moment and the no. of electrons. Silicides of the general formulæ Si_2M and SiM were studied. Si_2Cr and Si_2Mn are diamagnetic, whilst Si_2Fe and Si_2Co are feebly paramagnetic. In all compounds the magnetic moment of the metal is zero. The Si appears to give up a sufficient no. of electrons to give the metal its complete magnetic shell of 10 electrons, 4 to Cr, 3 to Mn, 2 to Fe, etc. For compounds with a smaller at. concn. of Si the ionisation diminishes with rising temp. and the moment reappears. SiMn does not follow Weiss' law. The

tendency of Si to yield electrons may account for the increase in its conductivity with temp. W. R. A.

Soft *X*-ray bands from dilute alloys. H. W. B. SKINNER and J. E. JOHNSON (Proc. Camb. Phil. Soc., 1938, **34**, 109—114).—The soft *X*-ray emission bands from Be and Al which are present as impurities in solid solution in Cu and Al show no well-defined high-energy edge, indicating that the valency electrons of the impurity atom are given up to the lattice, and that those electrons of the lattice which have energies close to the max. energy of the conduction electrons are not taken up by the impurity atom. F. J. L.

Crystallisation in metals during transformations in the solid state. S. T. KONOBEEVSKI (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1209—1244).—The phenomena of phase transformations in solid solutions (alloys) are discussed. R. T.

Crystal structure and ferromagnetism of alloys. U. DEHLINGER (Z. Metallk., 1937, **29**, 388—395).—Ferromagnetism occurs only in alloys containing one or more of the elements Fe, Co, Ni, Mn, Cr; saturation moment and Curie temp. of ferromagnetic alloys are affected only by relatively large changes in the composition but remanence and coercivity are affected by any change which modifies the structure or state of stress of the alloy. A large increase in coercivity occurs during the preliminary stages of a pptn. or transformation reaction and conversely magnetic softness is induced by additions which restrain transformation or by a heat-treatment which relieves internal stress. With Fe, Mn, or Cr alloys high saturation moments are obtained with a loosely-packed lattice structure such as is obtained by producing a body-centred lattice (Fe alloys only), by addition of Cu, Ag, Au, or other metal with an at. radius > that of the principal component of the alloy, by producing an ordered lattice structure in which Fe, Mn, or Cr atoms are not adjacent to one another in the first sphere, or by broadening the lattice by addition of non-metallic elements which fill its interstices. The ferromagnetism of alloys of Mn and the Fe group metals with other metals which obey the Hume-Rothery rule is also discussed. A. R. P.

Different types of precipitation [in alloys]. U. DEHLINGER (Z. Metallk., 1937, **29**, 401—403).—Pptn. phenomena in alloys may be classified into three types analogous to certain types of gas reactions: (*a*) pptn. producing hardening at room temp. and undetectable by *X*-ray examination or microscopically, due to complex formation and analogous to a homogeneous gas reaction; (*b*) high-temp. pptn. in which a constituent is pptd. homogeneously in a highly disperse form; this can be detected by *X*-rays by the steady displacement of the lines due to the solid solution phase (analogous to a boundary surface gas reaction); and (*c*) high-temp. pptn. in which a constituent is pptd. heterogeneously from the grain boundaries inwards; this can be detected by *X*-rays by the appearance in the same specimen of lines due both to the initial and final stages of the reaction (analogous to autocatalysed boundary surface gas reactions). A. R. P.

Ternary and quaternary eutectic alloys. E. JÄNECKE (Z. Metallk., 1937, **29**, 367—373).—A ternary eutectic is formed only when binary eutectics occur in the constituent binary systems; its composition always lies within the triangle formed by joining the binary eutectic points in the ternary diagram. The ternary eutectic temp. of the systems Bi–Cd–Sn, Cd–Pb–Sn, Bi–Pb–Sn, and Bi–Cd–Pb are 103°, 144·1°, 95·5°, and 91·5°, respectively; addition of Zn to these eutectics leads to quaternary eutectics at 100·2°, 137°, 93·5°, and 90·9°, respectively, but addition of Zn to the quaternary Bi–Pb–Sn–Cd eutectic does not lower the m.p. The equilibria in quaternary systems of Tl with three of the metals Pb, Sn, Bi, and Cd are complicated by the existence of the stable compounds $PbTl_2$, Bi_2Tl, and $BiTl_8$; Sn forms a eutectic with $PbTl_2$ at 181·8°, but there are no ternary eutectics in the Sn–Pb–Tl or Cd–Pb–Tl systems. Bi_2Tl forms a binary eutectic with Sn at 168° and with Cd at 144·2°; the Bi–Tl–Sn and Bi–Tl–Cd systems both have two ternary eutectic points, one at 124° and the other close to the Tl–Sn or Tl–Cd binary eutectic. The Pb–Tl–Bi system has ternary eutectics at 90·8° and 186·4° whilst quaternary eutectics occur in the Pb–Sn–Bi–Tl system at 93°, in the Pb–Cd–Bi–Tl system at 81°, and in the Sn–Cd–Bi–Tl system at 94·6°. Addition of 6% Tl to Wood's metal reduces the eutectic temp. to 67° but all the Tl enters into solid solution in the Pb, whilst Al is insol. in the molten alloy, Mg forms compounds with all the components, and Sb is completely miscible with the molten alloy but no quinary eutectic is formed. A. R. P.

Lattice changes associated with formation of superlattices in alloys. A. H. WILSON (Proc. Camb. Phil. Soc., 1938, **34**, 81—88).—A theoretical account of the Au–Cu superlattice. Bethe's order–disorder theory of alloys is generalised so as to include transitions in which the lattice changes from cubic to tetragonal. F. J. L.

Order and disorder in binary solid solutions. J. G. KIRKWOOD (J. Chem. Physics, 1938, **6**, 70—75).—The order and disorder in solid solutions are derived from the cryst. partition function. W. R. A.

Critical ordering temperature in alloys. II. Existence of a two-phase region. C. E. EASTHOPE (Proc. Camb. Phil. Soc., 1938, **34**, 68—80).—Theoretical. The crit. ordering temp. T_c for alloys of the type AB_3 is max. when $c = \frac{1}{2}$. At lower temp. there is a concn. range within which the alloy exists in a two-phase state, one partially ordered and the other disordered. It vanishes at $T = 0$ and $T = (T_c)_{max.}$. F. J. L.

Electrochemical investigations on solid metallic alloys. A. ÖLANDER (Z. Metallk., 1937, **29**, 361—366).—A review of recent work on electrochemical potentials, order–disorder transformations, mixture entropy, and heats of transformation. A. R. P.

Diffusion of gases in liquids under pressure. II. Influence of temperature. V. V. IPATIEV and V. P. TEODOROVITSCH (J. Phys. Chem. Russ., 1937, **10**, 712—718; cf. A., 1934, 138).—The amount Q of H_2 dissolved in H_2O after time t, if the area of

contact is πr^2 and the solubility (vol. in vol.) is S, is given by $6Q^2 = D\pi r^4 S^2 t$. The diffusion coeff. D between 30 and 125 atm. is independent of the pressure and increases rapidly with rise of temp. (15—200°). J. J. B.

Ionisation of hydrogen by diffusion through palladium. R. G. STANSFIELD (Proc. Camb. Phil. Soc., 1938, **34**, 120—123).—No ionisation is found in H_2 leaving Pd, when the gas either diffuses through the metal or is evolved by warming Pd previously charged with H_2. F. J. L.

Solubility. V. Validity of Henry's law for the calculation of vapour solubilities. J. H. SAYLOR, J. M. STUOKEY, and P. M. GROSS (J. Amer. Chem. Soc., 1938, **60**, 373—376). From measurements of the partial pressures of C_6H_6, $C_2H_4Cl_2$, and $COEt_2$, respectively, in the vapours in equilibrium with their aq. solutions at 30° and from confirmatory tests it is concluded that Henry's law is applicable at concns. <300—400 millimol. per 1000 g. of H_2O. The calculation of vapour solubilities is discussed. E. S. H.

Solubilities of red and yellow mercuric oxides in water, in alkali, and in alkaline salt solutions. Acid and basic dissociation constants of mercuric hydroxide. A. B. GARRETT and A. E. HIRSCHLER (J. Amer. Chem. Soc., 1938, **60**, 299—306).—Solubility data for red HgO in H_2O and aq. NaOH, and for yellow HgO in H_2O and aq. NaOH, KOH, LiOH, KNO_3–NaOH, $NaNO_3$–NaOH, and Na_2SO_4–NaOH at 25° are recorded. In each case solubility is a linear function of concn. up to approx. N-alkali. The solubility of yellow HgO is generally about 5% > that of red HgO. HgO is shown to be amphoteric by the constancy of the equilibrium const. for $HgO + OH' = HHgO_2'$. The dissociation const. for $H_2HgO_2 = H^+ + HHgO_2'$ is calc. as $1{\cdot}4 \times 10^{-15}$; that of $Hg(OH)_2$ as a base is $1{\cdot}8 \times 10^{-22}$. The difference in free energy between red and yellow HgO is 31 g.-cal per mol. E. S. H.

Solubility of cuprous cyanide in aqueous sodium and potassium cyanide. I. N. PLAKSIN and C. E. FISCHKOVA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 229—244).—The solubility of CuCN in aq. KCN or NaCN and the d of the solutions have been determined at 15°, 25°, and 35°. The solid phases in equilibrium with the saturated solutions are $Na_2Cu(CN)_3$, $K_2Cu(CN)_3$, $NaCu(CN)_2$, $KCu(CN)_2$, $Na_4Cu(CN)_5$, and possibly $K_3Cu(CN)_4$. R. T.

Solubility of oxides in molten boric anhydride, at 1200°. M. FOËX (Compt. rend., 1938, **206**, 349—350; cf. A., 1904, ii, 614).—The oxides X_2O (X = Li, Na, K, Rb, Cs, Cu^I, Ag, and Tl), PbO, As_2O_3, Sb_2O_3, Bi_2O_3, V_2O_5, and MoO_3 are miscible in all proportions. XO (X = Be, Mg, Ca, Mn, Co, Ni, Zn, Sr, Cd, and Ba), La_2O_3, and Ce_2O_3 give two layers, the lower consisting of a fused borate, and the upper of a solution of the oxide in B_2O_3; the solubilities, which are recorded, increase with the mol. wt. of the oxide. In the series XO_2 (X = Si, Ti, Zr, Sn, Th) the solubilities decrease with increasing mol. wt. Vals. for P_2O_5 and WO_3 are also recorded. A. J. E. W.

Acid salts of monobasic acids. IV. Salting-out effect. J. D. M. ROSS, T. J. MORRISON, and C. JOHNSTONE (J.C.S., 1938, 264—268).—The salting-out effect of the ions has been calc. from solubility data for r- and (+)-OH·CHPh·CO_2H in presence of chlorides and nitrates. The correction for this effect is applied to similar data for the influence of metallic mandelates (cf. A., 1933, 1013; 1936, 937; 1937, I, 298) in order to ascertain the extent of complex formation in solution. The extent for the r-acid is approx. twice that for the active acid, and in each case is independent of the nature of the metallic ion. The data suggest that with the r- and the active acid the 3 : 1 and 1 : 1 acid salts respectively exist in solution. C. R. H.

Solubility of cellulose and its esters. II. Applicability of the phase rule to solutions of cellulose esters. S. PAPKOV, V. KARGIN, and Z. ROGOVIN (J. Phys. Chem. Russ., 1937, **10**, 607—619; cf. A., 1938, I, 24).—Cellulose acetate (I) + $CHCl_3$ and (I) + $(CH_2Cl)_2$ each give two liquid pairs, the crit. temp. of dissolution being approx. 57° for both systems. (I) is deposited as a solid phase on cooling its solutions in $PhNO_2$, $COMePr^a$, COMeEt, MeOH, C_6H_6, and EtOAc; t_c is approx. 80°, 115°, 25°, 120°, 210°, and 10°, respectively. From solutions in CH_2Ph·OH (I) separates as a gel. Swollen (I) is a solution of the solvent in (I); the phase rule is applicable to all systems consisting of (I) and a solvent. J. J. B.

Ageing of fresh precipitates. XVIII. Mixed crystal formation between barium sulphate and potassium permanganate. I. M. KOLTHOFF and G. E. NOPONEN (J. Physical Chem., 1938, **42**, 237—243; cf. A., 1938, I, 134).—On shaking freshly pptd. $BaSO_4$ with aq. $KMnO_4$ distribution equilibrium is reached in 15—30 days. The same equilibrium is reached from the opposite direction when the $KMnO_4$ is co-pptd. with the $BaSO_4$. The concn. of $KMnO_4$ in the solid is diminished in presence of $NaNO_3$ or (to a smaller extent) of NaCl, and increased in presence of KNO_3. F. L. U.

Adsorption of vapours of dimethyl, diethyl, and di-n-propyl ethers by activated charcoal. J. N. PEARCE and P. E. PETERS (J. Physical Chem., 1938, **42**, 229—235; cf. A., 1935, 929).—Isotherms are given for temp. from 0° to 183°. The results are satisfactorily expressed by Langmuir's equation in the pressure range studied (0—650 mm.), except for Me_2O at higher temp. At low pressures the higher-boiling ether is adsorbed more strongly; as the pressure is increased the order of adsorption is reversed. Heats of adsorption are calc. F. L. U.

Adsorption of gases on surfaces as a particular case of dissociation equilibrium. F. CERNUSCHI (Compt. rend., 1938, **206**, 585—587).—Formulæ for adsorption may be deduced more easily using the law of mass action than by the use of statistical mechanics (cf. Fowler, A., 1935, 818). R. S. B.

Adsorption of gases on plane surfaces of mica. M. B. ARMBRUSTER and J. B. AUSTIN (J. Amer. Chem. Soc., 1938, **60**, 467—475).—The adsorption of A and CO by mica at −183° has been determined. At saturation the mica is completely covered with a unimol. layer of CO, but only 17% of the surface is

covered by A. Adsorption is not instantaneous. Approx. 75% of the adsorbed CO can be removed by pumping at −183°; the remaining 25% can be removed by pumping at higher temp. The strongly bound CO mols. and A appear to be adsorbed at active centres, which are probably the points on the mica surface from which K is removed on cleavage. Adsorption of CO follows the Langmuir isotherm; that of A follows the Langmuir equation for two kinds of elementary spaces. The spreading force of adsorbed CO varies with the surface area per mol. in the same way as the spreading force of insol. films on H_2O. The adsorbed gas follows a two-dimensional van der Waals equation. The spreading force for adsorbed A is very small. E. S. H.

Adsorption of helium gas used for thermal conduction in calorimetry near 1° K. Heat of adsorption. J. W. STOUT and W. F. GIAUQUE (J. Amer. Chem. Soc., 1938, **60**, 393—395).—Equilibrium pressures have been measured for amounts of He calc. to form uni- or bi-mol. surface layers on $NiSO_4,7H_2O$. Heats of adsorption for different pressures at 4·23° K. have been determined. E. S. H.

Adsorption of gases in multimolecular layers. S. BRUNAUER, P. H. EMMETT, and E. TELLER (J. Amer. Chem. Soc., 1938, **60**, 309—319).—The polarisation theory of multimol. adsorption is critically discussed. It is shown that the adsorption energy due to attraction of dipoles induced in a non-polar gas is insufficient to constitute a major portion of the binding energy between adsorbed layers. Adsorption equations for multimol. adsorption have been derived on the assumption that the forces producing condensation are also responsible for multimol. adsorption. The equations are applied to experimental data. E. S. H.

Determination of the true adsorption of the solvent and of the dissolved substance in concentrated solutions. M. DOBINE (Compt. rend., 1938, **206**, 430—432).—Separate isotherms for the adsorption of H_2O and AcOH are deduced from previous results (A., 1938, I, 134). In each case the adsorption increases with concn., the isotherms being convex towards the concn. axis. A. J. E. W.

Mechanism of the electrolyte adsorption by aluminium hydroxide sols. Z. J. BERESTNEVA and V. A. KARGIN (J. Phys. Chem. Russ., 1937, **10**, 593—600).—An Al amalgam electrode in $Al(OH)_3$ sol becomes more negative if Na_2SO_4 is added. Presumably the effect is due to pptn. of a basic Al sulphate on the colloid particles. The ion which determines the potential of an Al amalgam electrode in the ultrafiltrate is univalent since a tenfold dilution of the ultrafiltrate changes the p.d. by approx. 0·05 v. J. J. B.

Simultaneous adsorption from dilute aqueous solutions. W. J. JONES, R. A. HUDSON, and J. T. JONES (J.C.S., 1938, 269—271).—The simultaneous adsorption on sugar charcoal of $COMe_2$, COMeEt, or $COMePr^{\alpha}$ and PhOH or NH_2Ph from aq. solutions has been investigated. The presence of ketones reduces the adsorbability of PhOH or NH_2Ph, and vice versa. C. R. H.

Adsorption of ions of water by precipitates. II, III. I. TANANAEV and N. I. MIRIANASCHVILI (J. Appl. Chem. Russ., 1937, **10**, 2082—2087, 2088—2095; cf. A., 1938, I, 76).—II. Ppts. of $PbCrO_4$ or PbC_2O_4 adsorb OH′ from neutral solutions. Only slight changes in p_H are found (colorimetrically) when Ag halides are pptd. from neutral solution; the p_H of such solutions cannot be determined potentiometrically (Pt or quinhydrone electrodes).

III. In titration of 0·5N-K_2SO_4 with 0·5N-$BaCl_2$ the p_H at first rises slightly, and then falls abruptly at the equiv. point. The effect is due to selective adsorption of H· in presence of SO_4'', and the process is represented: $n BaSO_4 + SO_4'' \rightarrow (BaSO_4)_n SO_4''$ (I); (I) + $2H_2O \rightarrow n BaSO_4,H_2SO_4 + OH'$. Adsorption of H· is greater in presence of K·. A method of titration of SO_4'' by standard $BaCl_2$, based on the above reaction (phenolphthalein or phenol-red indicators), is described. R. T.

Determination of dynamic activity of sorbents, and a method of obtaining air–vapour mixtures of constant composition. V. K. MARKOV and G. D. DACHNIUK (J. Appl. Chem. Russ., 1937, **10**, 2096—2104).—The dynamic activity of sorbents can be determined accurately only when the concn. of adsorbate in the gas is maintained const. This is achieved by passing a current of gas through a layer of saturated sorbent, when the concn. of the vapour does not vary until desorption is practically complete. R. T.

Adsorption by the mercury dropping electrode in relation to the maxima of the polarographic current–potential curves. A. WINKEL and H. SIEBERT (Z. Elektrochem., 1938, **44**, 127—132).—Electrocapillary curves in electrolyte solutions of different concns. obtained by the drop-wt. method show agreement with those given by static methods in N and 0·1N solutions; deviations at lower concns. are attributed to incomplete adsorption equilibrium. E. S. H.

Sorption hysteresis and the vapour pressure of concave surfaces. L. H. COHAN (J. Amer. Chem. Soc., 1938, **60**, 433—435).—Theoretical. The v.p. in equilibrium with the interior of a cylindrical shell of liquid is given by $P_r = P_0 e^{-\sigma V/rRT}$, where r is the internal radius. From the equation it is deduced that hysteresis must be expected in certain sorption systems. E. S. H.

Homogeneous transformation points in unimolecular layers. D. G. DERVICHIAN and M. JOLY (Compt. rend., 1938, **206**, 326—328).—Anomalies in the variation of the compressibility, rate of flow, and the electric moment of the mols., during isothermal compression, have been observed for unimol. layers in the solid, liquid, and gaseous states. These anomalies are found at sharply defined vals. of the surface area occupied by each mol. (triolein, 115; oleic acid, 36 and 42; stearic acid, 19·5; trihexoin, 100 and 120 sq. A.). Adsorption layers of fatty acids show similar properties, and the anomalies in this case are probably due to the mols. ceasing to have their normal orientation in which their length is parallel to the surface. A. J. E. W.

Adsorption layers in disperse systems. XVI. Peptising and coagulating capacity of the soaps of the homologous series of fatty acids. N. N. SERB-SERBINA (J. Phys. Chem. Russ., 1937, **10**, 627—635).—The peptisation of $CaCO_3$, Pb_3O_4, graphite, and soot and the flotation in presence of $BuCO_2Na$, $C_7H_{15}\cdot CO_2Na$, $C_9H_{19}\cdot CO_2Na$, $C_{11}H_{23}\cdot CO_2Na$, and Na oleate have been examined. The peptisation by Na oleate increases during the ageing of the solutions and decreases with temp.; the flotation shows an opposite behaviour. J. J. B.

Lowering of the surface tension of hydrochloric acid by organic bases. E. JENCKEL [with H. POETSCH] (Z. anorg. Chem., 1938, **235**, 254—256).—Relative vals. have been obtained for the capillary activity of a no. of org. bases in 3N-HCl. They show no definite correlation with the corresponding inhibiting effects on the dissolution of metals. F. J. G.

Surface tension and viscosity in the mutual system $2NaCl + MgSO_4 \rightleftharpoons Na_2SO_4 + MgCl_2$. V. I. NIKOLAEV and E. E. BUROVAJA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 245—258).—Data for 25° are recorded and discussed. R. T.

Properties of detergent solutions. IV. Influence of hydrogen-ion concentration on the interfacial tension of soap solutions. J. POWNEY and C. C. ADDISON. **V. Hydrolysis of soaps as determined from glass electrode p_H measurements.** J. POWNEY and D. O. JORDAN. **VI. Surface activity and critical concentrations of aqueous solutions of saturated soaps under conditions of suppressed hydrolysis.** J. POWNEY and C. C. ADDISON (Trans. Faraday Soc., 1938, **34**, 356—363, 363—371, 372—377).—IV. Interfacial tensions of buffered and unbuffered aq. Na and K oleates and laurates, Na linoleate, and K myristate against PhMe have been determined over a wide range of p_H. The variation with p_H and with concn. of neutral salt is discussed. The nature of the species responsible for the activity at an oil–solution interface differs from that operative at an air–solution interface.

V. The degree of hydrolysis of Na laurate, myristate, palmitate, stearate, oleate, linoleate, and ricinoleate has been determined over the approx. concn. range 0·00001—0·1M. The abnormal hydrolysis observed in certain concn. ranges is discussed in relation to the mechanism of acid soap formation. The degree of hydrolysis of 0·003M-Na oleate in aq. MeOH, EtOH, Pr$^\alpha$OH, and Bu$^\alpha$OH has been determined.

VI. Surface and interfacial tension (against PhMe) data are recorded for aq. Na laurate, myristate, palmitate, and stearate at 70°. Under conditions of suppressed hydrolysis these soaps behave in a manner characteristic of unhydrolysed, long-chain colloidal electrolytes, such as Na alkyl sulphates. The concn. curves obtained show well-defined crit. concns., which change in a regular way with chain length. The crit. concn. is lowered considerably by addition of neutral salts such as NaCl. E. S. H.

Oxide films formed on heated iron. T. IIMORI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, **34**, 60—67).—The oxide layers on Fe have been studied by observations on electron diffraction (cf. A., 1937, I, 555). An unknown primary oxide of Fe is formed at 200—250°. At <340° γ-Fe_2O_3 is formed from etched Fe, and α-Fe_2O_3 from polished Fe. R. S. B.

Electrical properties of ω-bromopalmitic acid films. M. GEROVITSCH and D. VARGIN (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1075—1084).—The films formed on dil. aq. solutions are stable at p_H 7—7·6; below p_H 7 aggregation, and above p_H 8·5 dissolution, of the films takes place. The p.d. amounts to −0·60 v. in absence, and to −0·87 v. in presence, of multivalent cations (0·0004M-$CuSO_4$, at p_H 7·5). R. T.

Electrokinetic aspects of surface chemistry. III. Comparison of the microscopic and moving boundary methods of electrophoresis. L. S. MOYER (J. Biol. Chem., 1938, **122**, 641—647).—At any given p_H val. between 4 and 8 the electrical mobility of horse-serum pseudoglobin adsorbed on microscopic collodion particles is equal to the mobility of this protein in solution. Similar data for horse-serum albumin are confirmed. The accuracy and simplicity of the microscopic method are emphasised and the results are discussed with reference to their immunological implications. J. W. S.

Theory of schiller layers. P. BERGMANN, P. LÖW-BEER, and H. ZOCHER (Z. physikal. Chem., 1938, **181**, 301—314).—Expressions connecting the distance between two lamellæ with the electrolyte of concn. c, and the dielectric const., ϵ, are derived. Observed distances in the case of schiller layers of H_2WO_4 agree with theory at low vals. of c, but are > the calc. distances at higher vals. In agreement with theory an increase of c is accompanied by a decrease in the distance. In 96% EtOH the observed vals. agree, except at high vals. of c, with the calc. vals., the latter being < the vals. for aq. solutions on account of the lower ϵ. C. R. H.

Capillary systems. XIX (7). Permeability of coherent and compact material for gaseous and dissolved substances. E. MANEGOLD and K. SOLF (Kolloid-Z., 1938, **82**, 135—150; cf. A., 1937, I, 612). —Mathematical. F. L. U.

Electrocapillary phenomena in fused electrolytes. S. KARPATSCHEV and A. STROMBERG (J. Phys. Chem. Russ., 1937, **10**, 739—746).—The behaviour of Zn–Sn alloys has been examined in the eutectic mixture of LiCl and KCl, and in a LiI–KI mixture at 400°. J. J. B.

Non-diffusion through parchment of oleic acid dissolved in solutions of salts of bile acid. H. J. VONK, CHR. ENGEL, and C. ENGEL (Biochem. Z., 1938, **295**, 171—182; cf. Breusch, A., 1937, I, 562).—When dissolved in solutions of Na glycocholate, oleic acid does not dialyse through parchment. W. McC.

Explanation of the Coehn–Raydt charge law [for electro-endosmosis of organic liquids]. A. J. RUTGERS (Physica, 1938, **5**, 54—59; cf. Ann. Physik, 1909, **30**, 777).—Theoretical. H. J. E.

Magnetic birefringence of benzene solutions of pinenes. J. RABINOVITCH (Compt. rend., 1938,

206, 342—344; cf. A., 1932, 448, 561).—Measurements made on solutions of α- and β-pinene (I) in C_6H_6 indicate the presence of a third mol. species formed by association of (I) and C_6H_6, possessing a magnetic anisotropy ≫ that of C_6H_6. A. J. E. W.

Dielectric constants of solutions of cellulose nitrates [and of cellite] in acetone, acetone–hexane, and ethyl acetate. S. Lee and I. Sakurada (J. Soc. Chem. Ind. Japan, 1937, **40**, 460B).—Dielectric consts. (ε) for various λλ obtained with a resonance apparatus show that the apparent sp. polarisation in $COMe_2$ and EtOAc solutions is almost independent of the concn. It may be inferred that in strongly polar solvents, cellulose nitrate and acetate are so strongly solvated that neither dipolar association nor change of solvation occurs over a wide range of concn. Since the apparent sp. polarisation in $COMe_2$–C_6H_{14} varies with the concn. it would appear that cellulose nitrates are associated in such solvents. Vals. for the mol. polarisation at infinite dilution, obtained by extrapolation, are practically identical with those in pure $COMe_2$. The apparent sp. polarisation of cellulose nitrates is only slightly dependent on the degree of nitration and on the viscosity. The apparent dipole moment, calc. from the apparent sp. polarisation and referred to the C_6-cellulose mol. as unit, lies between 1·666 and 1·791. ε of the solutions increases slightly with λ. The dependence of ε on the frequency is almost identical for unequally viscous cellulose nitrates. The apparent dipole moment of cellite in $COMe_2$, referred to the C_6-cellulose mol., is approx. the same as that of cellulose triacetate in $CHCl_3$. E. F.

Measurements of the velocity of the Brownian movement of a torsion balance. E. Kappler (Ann. Physik, 1938, [v], **31**, 377—397; cf. *ibid.*, 1932, [v], **15**, 545).—Velocity measurements have been made from the registration curve of a torsion balance in Brownian movement. The velocity shows Gaussian distribution. The val. derived for the Boltzmann const. is $k = 1{\cdot}36 \times 10^{-16}$ (±3%) erg per degree. The Maxwell–Boltzmann distribution law is verified. The distribution of the impulses is calc. and and the damping shown to be ∝ to the mean square of the impulse. The frictional damping is identical with that for macroscopic vibration. O. D. S.

Effect of polarised light on the Brownian movement. J. Kolb (Physikal. Z., 1938, **39**, 194—197).—The Brownian movement has been studied with Au particles of accurately determined magnitude; previous observations of Pospíšil (A., 1927, 823) and Fürth *et al.* (A., 1935, 1459) on the effect of polarised light on the Brownian movement have been confirmed. The movement in the direction of the magnetic vector is unaffected, but that in the direction of the electric vector and the direction of propagation of the light is lowered by 10—20% according to intensity of light and size of particle. A. J. M.

[Effect of polarised light on the Brownian movement.] A. Deubner (Physikal. Z., 1938, **39**, 198).—Polemical against Kolb (preceding abstract). A. J. M.

[Effect of polarised light on the Brownian movement.] R. Fürth (Physikal. Z., 1938, **39**, 198—199).—A reply to Deubner (preceding abstract). A. J. M.

Mobility spectrum of large [gaseous] ions. O. Te-Tchao (Compt. rend., 1938, **206**, 240—242; cf. A., 1928, 102; 1937, I, 498).—The mobility spectrum of charged smoke particles under the action of an alternating electric field has been determined by ultra-microscopic measurement of the lengths of their trajectories. A. J. E. W.

Polydispersity and multimolecularity. W. Ostwald (Kolloid-Z., 1938, **82**, 226—228, and Z. Elektrochem., 1938, **44**, 152).—A recent paper by Schulz (A., 1938, I, 137) is criticised. F. L. U.

Mol. wt. and viscosity of high polymerides. H. Staudinger (Kolloid-Z., 1938, **82**, 129—131).—Some results obtained by the author and his co-workers, mention of which was omitted in a recent paper by Dobry (A., 1938, I, 28), are re-stated. F. L. U.

Highly polymerised compounds. CLXXXV, CLXXXVI. Heteropolar colloid molecules. I. Polyacrylic acid, a type of protein. II. Viscosity of solutions of polyacrylic acids and their salts. W. Kern (Z. physikal. Chem., 1938, **181**, 249—282, 283—300).—I. The degree of dissociation, conductivity, and osmotic pressure, Π, of aq. solutions of polyacrylic acids, all considered as monobasic, are shown to be independent of the degree of polymerisation (*P*). In the case of the second and third properties this independence extends to solutions of the alkali salts. Comparisons are made with $Pr^{\beta}CO_2H$. The val. of Π increases as the acid is progressively neutralised, but the rate of increase rapidly diminishes on account of what is termed a "buffering" effect of Π, due to the influence of large mols. on the osmotic activity of small mols. This effect is discussed in relation to similar effects observed in nature in connexion with nucleic acids.

II. In dil. solutions the sp. η decreases and then increases with increase in concn. *c*, the min. val. occurring at 0·1—0·3N (N refers to the basic acid irrespective of *P*). Solutions of the alkali salts show a similar behaviour. Distinction is made between the ionic factor which is evident at low vals. of *c*, and to the macromol. factor which is evident at high vals. The rate of increase of η which follows the progressive neutralisation of the acids diminishes as neutrality is reached. This effect is compared with the Π "buffering" effect. C. R. H.

Highly polymerised compounds. CLXXXIV. Importance of the shape of macromolecules in colloid chemistry. H. Staudinger (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 494—503).—A discussion. C. R. H.

Solubility relations of high-molecular substances. J. N. Brønsted (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 99—108).—Recorded data lead to the conclusion that pure liquids belong to two groups, solvents and non-solvents, and that a series of liquids showing graduated solubility is impossible. Mixtures of solvent and non-solvent also fall into two

groups, solvent type and non-solvent type, the two groups being separated by a crit. mixture in which the solubility is practically undefined. Similarly there is a crit. solution temp. separating two ranges in which the liquid acts as solvent and non-solvent. Experiments with polystyrene (I) as solute and C_6H_6–MeOH and C_6H_6–*n*-C_8H_{18} as solvent–non-solvent mixtures verify the existence of a crit. composition and show that this is independent of the amount of (I) present. It has also been shown that of two consecutive members of an ester series, one can be a solvent and the other a non-solvent; *e.g.*, Me and Et laurate are solvents and Pr and Bu laurate are non-solvents, and a crit. mixture of the Et and Pr laurates has been obtained. C. R. H.

Viscosity of solutions of chain-like molecules. I. SAKURADA (Z. physikal. Chem., 1938, **B**, **38**, 407—423).—The Staudinger empirical η equation is derived from theoretical considerations. Observed and calc. vals. for the lengths and diameters of various types of chain-like mol. are compared, and the limits of the applicability of the η equation are discussed. H. J. E.

Influence of concentration on viscosity of colloids. D. N. CHAKRAVARTI (Nagpur Univ. J., 1936, Part 2, 26—42).—The η of sols of 2 org. and 16 inorg. substances has been determined at different concns. The degree of hydration calc. from the equations of Einstein, Hess, or Arrhenius varies greatly with concn. The results are attributed partly to structure formation. F. L. U.

Emulsions. J. L. VAN DER MINNE (Chem. Weekblad, 1938, **35**, 122—124).—A general survey. F. L. U.

Viscosity of oil–water emulsions. G. BROUGHTON and L. SQUIRES (J. Physical Chem., 1938, **42**, 253—263).—The η of emulsions of Nujol, C_6H_6, and olive oil in H_2O has been determined at 25° for varying rates of shear, using as emulsifiers saponin and Na and $N(C_2H_4{\cdot}OH)_3$ oleates. For vol. concns. between 50 and 80% η decreases with increasing rate of shear to a limiting val. which increases with vol. concn. Over wide ranges the relation between shearing stress and rate of shear is linear, and extrapolation to zero rate gives a "yield point" which appears at a vol. concn. depending on the emulsifier used. The magnitude of the limiting η for a given vol. concn. depends mainly on the emulsifier, being smaller when the latter is more efficient. The relation between concn. and limiting η is best expressed by a modified form of Richardson's equation (A., 1933, 1115). F. L. U.

Variation of internal friction of lyophilic colloids. II. Suspensions of lyophilic colloidal powders. C. ROSSI (Gazzetta, 1937, **67**, 751—776; cf. A., 1938, I, 137).—Measurements for aq. suspensions of bentonite have been made by the rotating-cylinder method previously described, and the influence of concn. and of speed of rotation has been studied. A viscosity hysteresis effect is found to exist, which is considered to be identical with thixotropy, and its mechanism is discussed. O. J. W.

Hydrophilic properties of colloids, and bound water. A. V. DUMANSKI (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1165—1208).—The hydrosphere of hydrophilic colloids is not sharply delimited from the medium; its dimensions are conveniently measured by determining the change in concn. of aq. glucose added to a colloidal solution, and is a function of temp. and of the concn. of indifferent solute and colloid. Heat effects are associated chiefly with formation of the inner, and to a much smaller extent of the outer, layers of the hydrosphere. Sources of error involved in the cryoscopic, dilatometric, colorimetric, refractometric, and the above method are discussed. Many of the changes taking place in colloidal systems are related to solvation. R. T.

Protective and sensitising action of hydrophilic colloids on hydrophobic sols. J. T. G. OVERBEEK (Chem. Weekblad, 1938, **35**, 117—121).—The phenomena are reviewed and an explanation is proposed. F. L. U.

Absorption and scattering of light in hydrophobic colloids. III. Laterally scattered light. F. B. GRIBNAU (Kolloid-Z., 1938, **82**, 158—164; cf. A., 1938, I, 138).—The intensity of light scattered at right angles to the direction of the incident beam has been measured for Au, Se, and mastic sols of different dispersities, at λλ 5000—6500 A. The results are in satisfactory agreement with Mie's theory for sols of high dispersity. F. L. U.

Emulsification with lyophobic colloids. J. L. VAN DER MINNE (Chem. Weekblad, 1938, **35**, 125—127).—Tetralin can be emulsified by shaking with a 0·5% $Fe(OH)_3$ sol. Xylene, medicinal paraffin, and kerosene hydrocarbons are emulsified only when sufficient electrolyte is added to the $Fe(OH)_3$ to cause incipient coagulation. F. L. U.

Lyotropic effects in lyophobic systems. A. VOET (Chem. Weekblad, 1938, **35**, 113—116; cf. A., 1937, I, 183).—A theoretical discussion. F. L. U.

Colloid chemistry of systems soaps–cresol–water. II. Viscosity of sodium stearate solutions in presence of cresols. E. ANGELESCU and V. CIORTAN (Kolloid-Z., 1938, **82**, 164—172; cf. A., 1930, 1366).—Addition of *o*-, *m*-, or *p*-cresol to aq. Na stearate solutions of concn. >0·1N at 50° and 60° gives rise to a max. in the η–cresol concn. curve. The max. η increases with increase of Na stearate concn., and in the order *p*-> *m*-> *o*-cresol. The sp. vol. of the soap in aq. cresols is > in H_2O. The results are in accord with the view that cresol increases both the degree of dispersion and the solvation. The dielectric const. is influenced similarly. F. L. U.

Nature of aqueous solutions of soaps, as surface-active semi-colloids. P. A. REHBINDER and N. N. PETROVA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1085—1101).—The detergent, *i.e.*, foam-promoting, emulsifying, and peptising action of soap solutions is connected with the colloidal nature of the solutions, and may hence be measured nephelometrically. Hydrolysis of the soaps is prevented by adding a certain definite amount of alkaline electrolytes to the solutions; further addition of neutral or alkaline electrolytes to such solutions causes increasingly coarse dispersion of the soap particles until complete coagulation results. The optimum

electrolyte concn. for a given soap is determined nephelometrically. R. T.

Theory of interaction of particles carrying double electrical layers, and the aggregative stability of hydrophobic colloids and disperse systems. B. DERJAGUIN (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1153—1164).—Theoretical. Formulæ, based on the Gouy–Debye–Hückel theory of diffuse ionic layers, are derived, from which the rate of coagulation of colloids may be calc. as a function of the ζ-potential, the radius of the particles, and the thickness of the ionic layer. Systems containing particles of a radius of the order of 10^{-6} cm. are stable when the ζ-potential >30 mv. R. T.

Solvation of surfaces, in connexion with the mathematical theory of stability of lyophilic colloids. V. Anomalous properties of thin films of liquids. B. DERJAGUIN and M. KUSAKOV (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1119—1152).—Solvation of surfaces is determined as a function of the thickness h of the solvent layer separating the surface from a gas bubble pressed against it, as determined interferometrically. The val. of h (1—3 × 10^{-5} cm.) is unaffected by the presence of KCl, up to 1N, in H_2O, but is greatly reduced by $Al^{'''}$, to immeasurably small vals. Stability and coagulation in colloidal solutions are interpreted on the basis of variations in h, and hence of the pressure exerted by the solvent film which prevents aggregation of the particles. For particles of radius >10^{-5} cm., the repulsive force ∝ the radius. Various properties of adsorption layers are explained in terms of the above theory. R. T.

Kinetics of formation and solvation of two-dimensional colloids. D. L. TALMUD (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1103—1117).—Mono-films of SiO_2, $Al(OH)_3$, or $Fe(OH)_3$ are obtained by spreading solutions of $SiCl_4$, $AlBr_3$, or $FeBr_3$ in C_6H_6 on H_2O or aq. NH_3; films of Ag or Ba myristate or cetoxide are prepared similarly by placing hexane solutions of the acid on aq. $AgNO_3$ or $BaCl_2$. The kinetics of the processes are studied by measuring the rate of fall of the surface pressure of the mono-film; these measurements suggest that the final aggregates in the resulting films consist of approx. 1000 mols. Adsorption of NH_3 by solutions of palmitic acid in paraffin, in which the acid mols. are oriented similarly to the mono-layers on H_2O, is a max. for unsaturated mono-films; this suggests that solvation is also a max. for such films. R. T.

Solubility of oil-soluble dyes in aqueous solutions of stable protecting colloids as examples of true reversible equilibrium. J. W. MCBAIN and T. M. Woo (J. Amer. Chem. Soc., 1938, **60**, 223—227).—The solubility of H_2O-insol. dyes in aq. detergents ∝ [detergent]^4 and the concn.^{4} of dye in a PhMe layer in equilibrium with them. The proportionality factor or "dye no." is a measure of the true protective power of the colloid. These reversible equilibria are independent of previous history and depend solely on the total composition of the system. E. S. H.

Dilatancy and its relation to thixotropy. H. FREUNDLICH and H. L. RÖDER (Trans. Faraday Soc., 1938, **34**, 308—316).—Dilatancy is observed in fine aq. suspensions of quartz or starch grains when the proportion of solid is 42—45 vol.-%. By determining the rate of motion of a sphere, which is pulled through the suspensions with varying shearing stresses, it is shown that the suspensions behave like normal viscous fluids at low rates of shear; with increasing rate of shear a disproportionately high resistance is observed, after which the speed of the sphere varies little with further increase of shearing stress. An explanation is advanced, based on the fact that the absence of adhesion between the particles in these systems facilitates unequal distribution on application of pressure, so that a wall with solid properties is formed, a cavity filled with liquid being produced elsewhere; when the pressure is released, uniform re-distribution to a liquid system occurs. Whilst suspensions of SiO_2 or starch grains in polar liquids (H_2O, EtOH, glycerol) show dilatancy, suspensions of the same solids in non-polar liquids (C_6H_6, CCl_4) are thixotropic. The dilatant systems have a small, and the thixotropic systems a large, sedimentation vol. E. S. H.

Electrochemistry of platinum sols. III. Positive platinum sols. N. A. BALASCHOVA and N. A. BAOH (J. Phys. Chem. Russ., 1937, **10**, 575—585; cf. A., 1936, 1067; 1938, I, 29).—If a Pt sol in aq. HCl or H_2SO_4 saturated with H_2 is slowly oxidised by dil. O_2, its electrical conductivity shows alternating rises and falls, and its cataphoretic potential changes for a short time from negative to positive. The results are compared with the changes of p.d. occurring when a Pt electrode saturated with H_2 is treated with O_2. J. J. B.

Magnetic birefringence of colloidal solutions of iron oxide. J. ERRERA, W. OOSTVEEN, and H. SACK (Rec. trav. chim., 1938, **57**, 185—193; cf. A., 1936, 286).—The double refraction of aged sols of Fe oxide in an alternating magnetic field (H) of 50 cycles exhibits no max., is negative throughout, and is approx. ∝ H^2. By comparing the effects of a continuous and an alternating field while varying the η of the sols, the curves are shown to represent the resultant of two superposed effects for which interpretations are offered. F. L. U.

Hydrosol of ferromagnetic iron oxide. T. KATSURAI (Kolloid-Z., 1938, **82**, 172—174).—The prep. of a Fe_3O_4 hydrosol with the help of ultrasonic waves is described. The sedimentation of the particles in a magnetic field has been studied. An equation is given for diffusion in a magnetic field. F. L. U.

Stability of hydrosols of silver halides. A. BASIŃSKI and S. SAWICKA (Rocz. Chem., 1937, **17**, 605—615).—At the isoelectric point AgX sols (X = Br, I) contain more $Ag^{\cdot}$ than X', at concns. of 0·001—0·01M-AgX; the same holds for 0·001M-AgCl, but for 0·01M-AgCl an excess of Cl' is found. R. T.

Zirconate sol formation: its dependence on the displacing power of anions. H. S. OWENS and J. L. TORGESEN (J. Amer. Chem. Soc., 1938, **60**, 264—265).—The aquo-displacing power of a series of anions (tartrate, citrate, succinate, malate, oxalate,

glycollate, lactate) is identical with that for peptisation, excepting succinate. Ignited ZrO_2 is peptised with difficulty. In the OH-acids the α-OH′ seems to chelate, yielding H· in the sol. E. S. H.

Colloid chemistry of tetra-alkylammonium salts. W. Ostwald and H. Roederer (Kolloid-Z., 1938, **82**, 174—194).—The prep. of highly purified NR_4I (R = Pr, Bu$^{\alpha}$, *iso*amyl) is described. The transformation of the colourless *iso*amyl salt (I) into the red pseudo-salt has been studied in CCl_4 solution at 18° and 70° by measurement of extinction coeffs. for λλ between 430 and 720 mμ. Solubilities of (I) in CCl_4 and of NBu^{α}_4I (II) in CCl_4 and C_6H_6 are given. In these solutions demixing occurs above a certain temp., but the process is irreversible and is ascribed to the formation of a compound with the solvent. All the salts studied [(I), (II), Pr, Et, Me] swell in C_6H_6 at room temp. The swollen crystals of (I) show an *X*-ray pattern different from that of the unswollen salt, presumably owing to compound formation. The swollen salt, when placed in saturated C_6H_6 vapour in a thermostat at 20°, loses 78% of its C_6H_6 in 89 hr. Both (I) and (II) when dissolved in CCl_4 exhibit structure-viscosity. F. L. U.

Dielectric study of acetone solutions of cellulose nitrate and acetate. S. Lee and I. Sakurada (Kolloid-Z., 1938, **82**, 194—203; cf. A., 1935, 701).—Measurements of ε of $COMe_2$ solutions of cellulose nitrates of different η and different degrees of nitration have been made at various λλ from 42 to 170 m. The apparent sp. polarisation (*P*), referred to the C_6 unit, lies between 1·666 and 1·791. *P* increases slightly with λ, and is scarcely affected by change in η or degree of nitration. In $COMe_2$ or EtOAc solution the *P* of both nitrate and acetate is independent of concn., whilst that of the nitrate in $COMe_2$–C_6H_{14} mixtures increases or decreases with concn. according to the degree of nitration. F. L. U.

Mutual coagulation of colloidal solutions. I. Interaction of ferric hydroxide and Prussian-blue sols. P. M. Barve, Y. S. Paranjpe, and B. N. Desai (J. Univ. Bombay, 1937, **6**, Part II, 50—56; cf. A., 1932, 463; 1933, 778).—The range of concns. over which mutual coagulation occurs has been determined for sols dialysed for different periods. This range is narrowest when the cataphoretic velocity of each sol, and hence the charge on the particles, is a max. This is explained by assuming that coagulation is due to mutual adsorption of oppositely charged particles with consequent decrease of the net charge; the width of the coagulation zone for different times of dialysis is discussed on this basis, the influence of electrolytic impurities also being considered. A. J. E. W.

Adsorption of weakly solvated colloids on solid adsorbents. I. Adsorption of colloidal ferric hydroxide on quartz. A. von Buzágh and E. Knepp6 (Kolloid-Z., 1938, **82**, 150—158).—The adsorption of colloidal $Fe(OH)_3$ (Graham) on quartz particles is not independent of the concn. The curves obtained show a min., a max., or both, according to the concn. and the particle size. The ζ-potential of the particles, calc. from measurements of their mobility, is less powerfully influenced by the sols than by their ultrafiltrates. There is a close connexion between ζ-potential and adsorption, the former showing a max. at the min. of the latter. F. L. U.

Liesegang rings in non-gelatinous media. IV. Periodic coagulation of dilute ferric hydroxide sols. V. Gore (Kolloid-Z., 1938, **82**, 203—207; cf. A., 1938, I, 138).—Dil. (~0·1%) $Fe(OH)_3$ sols exhibit banded coagulation when in contact with electrolyte solutions of suitable concn. in long narrow (4 mm.) tubes. Banded structures have been obtained with $AgNO_3$, $BaCl_2$, K_2SO_4, and KBr. F. L. U.

Hydrophilic action of soaps and bile salts towards lecithin. G. Valette (Bull. Soc. Chim. biol., 1937, **19**, 1676—1682).—At p_H 9·8—10·8, Na myristate has a more intense hydrophilic action than Na laurate, but the reverse holds good below p_H 9·8. The activity of Na salts of unsaturated acids ∝ the no. of double linkings in the mol. Na ricinoleate has a more intense action than other soaps at about p_H 7, whilst the conjugated bile acids have a more powerful solvent effect than any soap. Above p_H 8·2, Na agaricinate has a stronger effect than even bile salts. P. G. M.

Variations in electric charge of proteins under the action of proteolytic enzymes. J. Loiseleur (Ann. Ferm., 1937, **3**, 575—599).—A procedure for measuring the mobility of quartz particles coated with protein is described. The error increases with decreasing ζ-potential and becomes 20% when the latter is <20 mv. F. L. U.

Effect of glycine on the activity coefficient of glycine, egg-albumin, and carboxyhæmoglobin. M. M. Richards (J. Biol. Chem., 1938, **122**, 727—743).—The activity coeff. (γ) of glycine at 25°, calc. from the relative v.p. depression of its solutions (concn. <1·7M), varies with the dielectric const. (ε) of the solution according to the relation $d \log \gamma/d(1/\epsilon) = 23{\cdot}4$. Distribution measurements on the effect of glycine on γ for egg-albumin indicate that a slight salting-out effect occurs. A method is described for the prep. of carboxyhæmoglobin crystals of reproducible solubility. This solubility is a max. in 1·6M-glycine. J. W. S.

Proteins as protective colloids. W. Pauli (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 416—426).—A review. J. N. A.

Imbibition of water by proteins. D. J. Lloyd (Cereal Chem., 1938, **15**, 25—34).—Part of the H_2O imbibed by proteins is easily removable by freezing, pressure, or evaporation. It decreases in quantity with diminishing activity of the H_2O, disappearing when the latter reaches 0·7, and is held by interionic forces. More firmly bound H_2O, present in const. quantity at activities 0·7—0·2, is apparently held by co-ordinate links between H_2O mols. and O and N atoms. A high % of firmly bound H_2O increases the resistance of plants to desiccation by frost or drought. E. A. F.

Electrophoresis of hydrocarbons and their simple derivatives as a function of p_H. J. C. Carruthers (Trans. Faraday Soc., 1938, **34**, 300—307).—The electrophoretic mobilities of *n*-$C_{18}H_{38}$, Δ$^{\alpha}$-*n*-octadecene, *n*-octadecyl, *n*-undecyl, *n*-octyl, and

Δ^{λ}-*n*-undecenyl alcohols, *n*-octyl bromide and iodide, Et stearate, and Et laurate have been determined in presence of 0·01N-$Na^{\cdot}$ at p_H 2—12. The mobilities cannot be correlated with dielectric const., but there is a qual. relation between electrophoretic mobility and the residual charge on the end-group of substituents. E. S. H.

Calculation of the dissociation constants of hypohalogenous acids from kinetic data. E. A. Shilov [with J. N. Gladtchikova] (J. Amer. Chem. Soc., 1938, **60**, 490—492).—By titration of the free acids with NaOH, using the glass electrode, the vals. obtained at 20° are: HOBr $2·06 \times 10^{-9}$, HOCl $3·16 \times 10^{-8}$. E. S. H.

Extent of dissociation of salts in water. V. Calcium mandelate. VI. Some calcium salts of organic acids. C. W. Davies (J.C.S., 1938, 271—273, 277—281).—V. The low conductivity of dil. aq. solutions of the salt suggests the presence of considerable amounts of $OH{\cdot}CHPh{\cdot}CO_2Ca^{\cdot}$, for which the calc. dissociation const. is 0·035. Assuming that this const. is the same for the *r*- and active mandelate, the ionic compositions of solutions shown by Levene and Rothen (cf. A., 1931, 149) to exhibit abnormal optical activity can be calc. The calc. mol. rotations for $OH{\cdot}CHPh{\cdot}CO_2Ca^{\cdot}$, 276°, and $OH{\cdot}CHPh{\cdot}CO_2Ba^{\cdot}$, 233°, differ greatly from the val. for $OH{\cdot}CHPh{\cdot}CO_2'$, 176·7°, and suggest that the constituents of the intermediate ions are united by a definite chemical linking.

VI. The solubility of $Ca(IO_3)_2$ in solutions of Na salts of org. acids has been determined, and the dissociation consts., *K*, of the intermediate ions of the Ca salts of the following acids have been calc. from the data. $OH{\cdot}CH_2{\cdot}CO_2H$, 0·026; $OH{\cdot}CHMe{\cdot}CO_2H$, 0·034; $NH_2{\cdot}CH_2{\cdot}CO_2H$, 0·042; $OMe{\cdot}CH_2{\cdot}CO_2H$ 0·076; $AcCO_2H$, 0·083; $OH{\cdot}CHMe{\cdot}CH_2{\cdot}CO_2H$, 0·15; $OH{\cdot}C_6H_4{\cdot}CO_2H$, 0·28; $CN{\cdot}CH_2{\cdot}CO_2H$, 0·28; AcOH, 1·0. The relation between structure and *K* is discussed. C. R. H.

Osmotic coefficients of various aqueous solutions of binary, tertiary, quaternary, and quinary sodium and potassium salts. E. Warburg (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 547—552).—Osmotic coeffs., calc. from f.p. measurements, are recorded for KCl, NaCl, KH_2PO_4, Na_2HPO_4, $K_2C_2O_4$, $Na_2C_2O_4$, Na_2 malonate, succinate, glutarate, adipate, pimelate, suberate, azelate, Na_3 and K_3 citrate, and $K_4Fc(CN)_6$. C. R. H.

Methyl-orange. N. Bjerrum (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 82—88).—Vals. for the mol. extinction coeff. of Me-orange (I) in various concns. in 0·03M-HCl and 0·03M-NaOH at 18°, 50°, and 80° agree with vals. obtained by Thiel. (I) is entirely in the red form in 0·03M-HCl and in the yellow in 0·03M-NaOH. C. R. H.

Dielectric constants of aqueous solutions of certain amino-acids. F. E. Lindquist and C. L. A. Schmidt (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 307—316).—The dielectric const. varies linearly with the concn. for glycine (I), *dl*-alanine (II), *dl*-proline, and, with slight deviations, for *l*-hydroxyproline. This appears to indicate that these NH_2-acids are not associated in aq. solution. Data for various temp. and for *l*-asparagine and creatine are recorded. The calc. dipole moments of (I) and (II) are, respectively, $20·8 \times 10^{-18}$ and $21·2 \times 10^{-18}$ e.s.u. C. R. H.

Physical chemistry of amino-acids, peptides, and related substances. XI. Solubility of cystine in the presence of ions and another dipolar ion. E. J. Cohn, T. L. McMeekin, and (Miss) M. H. Blanchard (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 142—153).—Glycine (I) and NaCl increase the solubility of cystine (II) at all concns. Na_2SO_4 at concns. <1 mol. also increases the solubility of (II), but at higher concns. its salting-out effect is > its solvent action. (I) and NaCl decrease the solvent action of each other. The interaction between (I) and (II) diminishes with increasing [NaCl], and the interaction between ions and (II) diminishes with increasing (I) concn. From theoretical considerations it follows that, with increasing (I) concn., the interaction between ions and dipolar ions which depends on Coulomb forces decreases whilst the salting-out effect increases; it also follows that the interaction between the dipolar ions decreases with increase in the ionic strength and the salting-out effect. C. R. H.

Co-ordination of metalloporphyrins with nitrogenous bases. W. M. Clark, J. F. Taylor, T. H. Davies, and R. Lewis (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 129—141).—Theoretical. Equations determining the equilibrium for different states of co-ordination in systems containing a metalloporphyrin which is subject to oxidation–reduction and co-ordinates with another substance are developed. Data for co-ordination compounds of Mn or Co mesoporphyrin and C_5H_5N or nicotine are used in illustration. C. R. H.

Cyano-complexes of the vanadous, chromic, manganic, hypovanadyl, uranyl, and manganous ions in the dissolved state. H. Brintzinger and F. Jahn (Z. anorg. Chem., 1938, **235**, 244—246).—The ionic wts. found by the method of dialysis for the ions $[V(CN)_6]'''$, $[Cr(CN)_6]'''$, $[Mn(CN)_6]'''$, $[VO(CN)_4]''$, and $[UO_2(CN)_4]''$ are normal, but the val. for $[Mn(CN)_6]''''$ corresponds with $[Mn(CN)_6(H_2O)_6]''''$. F. J. G.

Non-aqueous solutions. V. A. Plotnikov (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 245—248).—The problems of non-aq. solutions are discussed. R. T.

Activity of lithium chloride solutions in *iso*-amyl alcohol. F. I. Trachtenberg and A. I. Brodski (J. Phys. Chem. Russ., 1937, **10**, 725—730).—The distribution of LiCl between H_2O and *iso*-$C_5H_{11}{\cdot}OH$ at 25° suggests that LiCl is completely dissociated in $C_5H_{11}{\cdot}OH$; its activity coeff. agrees with the theory of Debye. J. J. B.

Thermodynamics of hydrochloric acid in dioxan–water mixtures from electromotive force measurements. II. Density data. H. S. Harned and C. Calmon. **III. Extrapolations according to the Gronwall–La Mer extension of the Debye and Hückel theory.** H. S. Harned. **IV. Properties of 20% dioxan mixtures.** H. S.

HARNED and J. G. DONELSON (J. Amer. Chem. Soc., 1938, **60**, 334—335, 336—339, 339—341; cf. A., 1936, 1463).—II. The *d* of HCl solutions in mixtures containing 20—82% of dioxan have been determined at 0—50°. The results are represented by equations.

III. Evaluation of the standard potentials of the cells H_2|HCl(*m*), *x*% dioxan, *y*% H_2O|AgCl–Ag by employing the extended Debye–Hückel theory affords excellent confirmation of the general theory.

IV. The activity coeff., relative partial mol. heat content, and heat capacity of HCl in 20% dioxan–80% H_2O have been computed from e.m.f. data over the ranges 0—50° and 0·005—3M. E. S. H.

Acid–base indicators in methanol. I. M. KOLTHOFF and L. S. GUSS (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 264—271).—The dissociation of indicators has been studied in pure MeOH at 25° by the use of buffers prepared from $CCl_3{\cdot}CO_2H$, $OH{\cdot}C_6H_4{\cdot}CO_2H$, BzOH, and veronal. The influence of the addition of 1% of H_2O is negligible. The ionisation const. of veronal, determined colorimetrically, is 4×10^{-13}. C. R. H.

Osmotic pressure of proteins in non-aqueous solvents. J. DUCLAUX and (MME.) A. DOBRY (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 155—160).—The osmotic pressure (Π) of gliadin in AcOH, $OH{\cdot}CHMe{\cdot}CO_2H$, 70% EtOH, and $Mg(ClO_4)_2$ has been measured at low concns. (*c*). Except in the case of $Mg(ClO_4)_2$, the val. of Π/c increases with *c*, but the rate of increase shows a gradual fall. With $Mg(ClO_4)_2$ Π/c decreases slightly with increase in *c* but measurements are not possible for $c > 0{\cdot}7\%$. In each of the solvents the mol. wt. of gliadin is approx. 40,000. C. R. H.

[Equilibrium constants of] reactions between phenolic alcohols and fatty acid esters.—See A., 1938, II, 136.

Influence of salts on equilibrium in the system alcohol–organic acid. N. A. SCHLESINGER and M. N. KIREEV (J. Gen. Chem. Russ., 1937, **7**, 2335—2343).—The equilibrium consts. *K* for the systems EtOH–R·CO_2H–H_2O–HCl–NaCl, KCl, or $CaCl_2$ (R = Me, Pr^n, Ph), at 19°, 100°, and 180°, are in good agreement with the vals. calc. from equations of the type $K = K_0 - aC$, where K_0 is the const. in the absence of salt, *a* is a const. for a given system, and *C* represents m.-equivs. of salt per g.-mol. of H_2O. The shift in *K* due to the salts cannot be ascribed to simple hydration of the salts. R. T.

Thermodynamic study of certain laws of heterogeneous equilibrium. L. A. ROTINJANZ (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1261—1276).—Theoretical. R. T.

Influence of miscibility on chemical equilibria. M. DODÉ (Ann. Chim., 1938, [xi], **9**, 139—156).—Previous work is summarised and discussed (A., 1937, I, 81, 463, 527). F. L. U.

Equilibrium vapour pressures in the three-phase system sodium iodide–water. P. DINGEMANS (Rec. trav. chim., 1938, **57**, 144—151).—V.p. for the following systems have been determined: $NaI,2H_2O$–solution–vapour (10—68°); NaI–solution–vapour (68—100°); $NaI,2H_2O$–NaI–vapour (10—68°). The results are compared with those of earlier work The transition temp. for $NaI,2H_2O \rightleftharpoons NaI + 2H_2O$ is 68·00°. F. L. U.

Aqueous vapour pressure of hydrated potassium ferrocyanide and of its saturated solutions at various temperatures. E. BOVALINI and E. FABRIS (Gazzetta, 1937, **67**, 802—807).—Measurements have been made over the range 25—104·2°. The transition of the trihydrate into the anhyd. salt occurs at 87·3°; the latent heat of evaporation of H_2O from the trihydrate is 12·78 kg.-cal. O. J. W.

System zinc oxide–titanium dioxide. Zinc orthotitanate and solid solutions with titanium dioxide. S. S. COLE and W. K. NELSON (J. Physical Chem., 1938, **42**, 245—251).—ZnO and TiO_2 begin to react at 430°. The only compound formed is Zn_2TiO_4. The first reaction product is a solid solution of TiO_2 in Zn_2TiO_4, with which ZnO reacts at an appreciable rate only above 600°. Limits of stability of the solid solutions are given. The composition of these extends to $Zn_2TiO_4 + 1{\cdot}5TiO_2$ and the spinel structure persists throughout. The unit cell of Zn_2TiO_4 has a_0 8·46 A., decreasing with increasing amounts of TiO_2 in solution. F. L. U.

Diphenyl and its derivatives. XIV. Phase diagrams of some binary systems. L. MASCARELLI and D. GATTI (Gazzetta, 1937, **67**, 807—812).—M.p. data and diagrams are given for mixtures of Ph_2 with 4 : 4′-dichloro- (eutectic at 79·9% Ph_2, m.p. 59·8°), 4 : 4′-dibromo- (82·5% Ph_2, 63·3°), 4 : 4′-di-iodo- (91% Ph_2, 66·8°), 2 : 2′-dichloro- (35% Ph_2, 32°), 2 : 2′-dibromo- (35·5% Ph_2, 39·5°), and 2 : 2′-di-iodo-diphenyl (55·1% Ph_2, 52·8°). E. W. W.

Chlorinates. II. Temperature–concentration equilibria in the system α-carbon tetrachloride–chlorine. Carbon perchlorides. J. A. WHEAT and A. W. BROWNE (J. Amer. Chem. Soc., 1938, **60**, 371—372; cf. A., 1937, I, 137).—F.p.–composition curves indicate the existence of $2CCl_4,Cl_2$, m.p. −67·0°, CCl_4,Cl_2, m.p. −90·5°, $CCl_4,2Cl_2$, m.p. −112·5°, $CCl_4,3Cl_2$, m.p. −115·5°, and $CCl_4,4Cl_2$, m.p. −114·0°. E. S. H.

Celite. System $3CaO,Al_2O_3$–$2CaO,Fe_2O_3$. T. YAMAUCHI (J. Japan. Ceram. Assoc., 1937, **45**, 433; Zement, 1938, **27**, 49).—One mol. of $2CaO,Fe_2O_3$ can take up to 0·25 mol. of $3CaO,Al_2O_3$ into solid solution without changing the lattice, but $3CaO,Al_2O_3$ can only take up small amounts of $2CaO,Fe_2O_3$. In richer mixtures $3CaO,Al_2O_3$ splits up into free CaO and a lower aluminate. G. H. C.

System $NaAlSiO_4$–FeO–SiO_2. N. L. BOWEN (Amer. Min., 1937, **22**, 206).—Fayalite (I) and albite (II) are binary compounds in a system with these components. The line, (I)–(II), divides the general triangle into two parts. One contains a ternary eutectic between (I), (II), and SiO_2 with 5% (I) at 980°; the other is complicated by the appearance of wustite and hercynite, but in the area where these phases are absent there is a eutectic at 990° [10% (I)] between nepheline, (II), and (I). The results throw light on the genesis of certain soda-rich rhyolites, trachytes, and phonolites. L. S. T.

Experiment on a three-component system. S. J. O'Brien and C. L. Kenny (J. Chem. Educ., 1937, **14**, 573—574).—Details for an elementary exploration of the system KCl–HCl–H_2O are given. L. S. T.

Equilibria in the ternary system magnesium chloride–magnesium sulphate–water, at 25°. D. N. Schoichet (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 317—322).—In presence of high concns. of $MgCl_2$, $MgSO_4,7H_2O$ undergoes progressive dehydration, via the 6-, 5-, and 4-hydrate, to a salt having $<1H_2O$; the reverse process takes place directly from the mono- to the hexa-hydrate. The salts yield a series of supersaturated solutions. R. T.

Equilibria in the mutual system potassium chloride–magnesium sulphate at 25°. N. S. Kurnakov and D. N. Schoichet (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 305—316).—Leonite (I), kainite (II), and kieserite do not separate spontaneously from the system KCl–$MgSO_4$–H_2O, but only after seeding the solutions. The possible solid phases are $MgSO_4$,1, 6, and $7H_2O$, (I), (II), schoenite, K_2SO_4, KCl, and carnallite. R. T.

Ice fields in the systems base–acid–water. Formation of phosphates, chromates, and borates. N. S. Kurnakov, M. I. Ravitsch, and N. V. Troitzkaja (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 275—304).—The ice fields (derived from temp. of crystallisation of H_2O) have been determined for the systems K_2O or NH_3–P_2O_5–H_2O, K_2O–CrO_3–H_2O, and Na_2O–B_2O_3–H_2O. KH_2PO_4, K_2HPO_4, K_3PO_4, $NH_4H_2PO_4$, and $(NH_4)_2HPO_4$, but not $(NH_4)_3PO_4$, are stable under the conditions employed. The results for the system K_2O–CrO_3–H_2O are analogous to those previously obtained for Na_2O–CrO_3–H_2O (Kurnakov *et al.*, A., 1935, 583). R. T.

Solubility of salts in liquid ammonia. The systems: NaCl–NaBr–NH_3 and NaCl–$NaNO_3$–NH_3 at 0°. M. A. Portnov and J. A. Ravdin (J. Gen. Chem. Russ., 1937, **7**, 2478—2485).—The solubility of NaBr rises from 117·6 to 1370 g. per kg. NH_3 as the temp. rises from −44·5° to 25°; that of $NaNO_3$ rises similarly from 706 to 1485 g. per kg. NH_3, over the range −50·5° to 60°. The solubility of NaBr or $NaNO_3$ in liquid NH_3 falls with increasing [NaCl]; the solid phases are NaCl, NaBr, and $NaNO_3$. Mixed crystals are not formed. R. T.

Equilibria in the system piperidine–phenol–water. R. V. Merzlin (J. Gen. Chem. Russ., 1937, **7**, 2490—2494).—An upper ternary crit. point is established. The 50—164° isotherms are not concentric, suggesting formation of a series of compounds or "berthollides." R. T.

Stratification in ternary systems. III. V. F. Ust-Katschkintzev (J. Gen. Chem. Russ., 1937, **7**, 2620—2625).—The phase diagrams (0—160°) are given for the system PhOH–NH_2Ph–H_2O–EtOH (14·1 and 27·3% EtOH). As a result of formation of the compound PhOH,NH_2Ph, the mixtures behave as ternary systems with a crit. point. R. T.

Double decomposition in absence of a solvent. XXXVI. Irreversible mutual system: potassium and sodium fluoride and bromide. N. S. Dombrovskaja and Z. A. Koloskova (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 211—228).—Fusion diagrams have been derived for the system KF + NaBr $\rightleftharpoons$ NaF + KBr. R. T.

Reciprocal salt pairs. II. V. A. Plotnikov and U. Schwarzmann (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 299—308).—In the system $AlBr_3$–$HgCl_2$ the reaction $2AlBr_3 + 3HgCl_2 = 2AlCl_3 + 2HgBr_2$ occurs. The system $AlCl_3$–$HgBr_2$ is a simple binary system. In the systems $AlBr_3$–AgCl and $AlCl_3$–AgBr, the complexes $AlBr_3$,AgCl and $AlCl_3$,AgBr are formed. H. J. E.

Simultaneous solubility of aluminium, sodium, potassium, and ferric nitrate in aqueous nitric acid. II. A. I. Saslavski, I. L. Ettinger, and E. A. Ezerova (J. Gen. Chem. Russ., 1937, **7**, 2410—2416).—Solubility data are recorded for the systems $NaNO_3$ or $Al(NO_3)_3$–HNO_3–H_2O, and $NaNO_3$–$Al(NO_3)_3$–HNO_3–H_2O, at 0° and 20°. The solid phases are $Al(NO_3)_3$,6, 8, and $9H_2O$, and $NaNO_3$. Double salts are not formed. R. T.

Solar evaporation of sea- and salt lake water. N. S. Kurnakov and V. I. Nikolaev (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 333—366).—Equilibria arising in the system $MgSO_4$–Na_2SO_4–$MgCl_2$–NaCl–KCl–H_2O, when evaporation proceeds under natural conditions, are discussed. R. T.

Data on theoretical metallurgy. VII. Thermodynamic properties of sulphur and its inorganic compounds. K. K. Kelley (U.S. Bur. Mines, Bull. 406, 1937, 146 pp.).—Published data are correlated and a self-consistent system of thermodynamic relations is worked out for the various states of S, SO_2, SO_3, SO, H_2S, SO_2Cl_2, Sb_2S_3, BaS, Bi_2S_3, CdS, CaS, CS_2, COS, CoS, Cu_2S, CuS, FeS, FeS_2, PbS, MnS, HgS, MoS_2, MoS_3, NiS, NH_4HS, PtS, PtS_2, RuS_2, Ag_2S, SrS, Tl_2S, WS_2, ZnS, $Al_2(SO_4)_3$, $BaSO_4$, $BeSO_4$, $CdSO_4$, $CaSO_4$, $CoSO_4$, $CuSO_4$, $FeSO_4$, $Fe_2(SO_4)_3$, $PbSO_4$, Li_2SO_4, $MgSO_4$, $MnSO_4$, Hg_2SO_4, $NiSO_4$, K_2SO_4, Ag_2SO_4, Na_2SO_4, $NaHSO_4$, $Na_2S_2O_7$, $SrSO_4$, Tl_2SO_4, $VOSO_4$, and $ZnSO_4$. The free energy relations derived are summarised in tabular form. The use of thermodynamic data in predicting the course of reactions is illustrated by examples. E. S. H.

Heat of formation and specific heat of aluminium carbide. S. Satoh (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, **34**, 50—59).—The sp. heat of Al_4C_3 has been determined at 0—99·6°, 0—244°, and 0—320·5°. The mol. heat is given by $24·2 + 3·274 \times 10^{-2}T - 4·09 \times 10^{-6}T^2$, where T is abs. temp. The heat of formation of Al_4C_3, calc. from data for the equilibrium $4AlN + 3C \rightleftharpoons Al_4C_3 + 2N_2$, is 63,200 g.-cal. R. S. B.

Heat of formation and specific heat of silicon nitride. S. Satoh (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 144—154).—Using a specimen containing about 12% SiO_2 and applying the requisite correction, the mean sp. heat of Si_3N_4 over the ranges 0—99·5°, 0—316·4°, and 0—585° has been determined. The true sp. heat is given by $C = 0·1656 + 1·847 \times 10^{-4}t - 4·5 \times 10^{-8}t^2$. By combining this with

equilibrium data for the reaction $Si_3N_4 = 3Si + 2N_2$ the heat of formation at 25° is 163,000 g.-cal.

F. J. G.

Heat of formation and specific heat of vanadium nitride. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 241—249).—The mean sp. heat of VN has been determined at 0—99·6°, 0—305·3°, and 0—458·6° and the true sp. heat is given by $0{\cdot}1351 + 2{\cdot}064 \times 10^{-4}t - 1{\cdot}057 \times 10^{-7}t^2$ where t = temp. The heat of formation (H) of VN from V and $\frac{1}{2}N_2$ is 66,000 g.-cal. The curve connecting H with at. no. for K, Ca, Sc, Ti, V, Cr, Mn, and Fe has a max. at Ti. The curves for the third, fourth, and fifth groups of the periodic table are similar. R. S. B.

Alunite. III. Y. ASADA (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 178—185).—The v.p. of H_2O from alunite has been measured by the dynamic method. The dehydration of alunite requires 8·5 g.-cal. per g. R. S. B.

Heat of neutralisation of potassium hydroxide and nitric acid in acid and alkaline solutions. N. K. VOSKRESENSKAJA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 259—273).—Max. heat of mixing of 4N-HNO_3 or -KOH with 4N-KNO_3 is obtained with the ratios $HNO_3 : KNO_3 = 1 : 2$, or $KOH : KNO_3 = 2 : 1$. R. T.

Isotope effect in solvation of ions and heats of dissolution. E. LANGE, W. MARTIN, and H. SATTLER (Z. ges. Naturwiss. Naturphil., 1936, **1**, 441—442; Chem. Zentr., 1936, i, 4882).—The difference in the heats of solvation of ions by H_2O and D_2O manifests itself in considerable differences in the integral heats of dissolution of salts in H_2O and D_2O, respectively, and in the v.p. of H_2O–D_2O–salt mixtures. Heats of dissolution are recorded for NaCl, KCl, KBr, and KI, and fractional distillation data for solutions of NaCl, NaOH, and $MgSO_4$. J. S. A.

Heats of organic reactions. VI. Heats of hydrogenation of oxygen-containing compounds. M. A. DOLLIVER, T. L. GRESHAM, G. B. KISTIAKOWSKY, E. A. SMITH, and W. E. VAUGHAN (J. Amer. Chem. Soc., 1938, **60**, 440—450; cf. A., 1937, I, 364).—Heats of hydrogenation of crotonaldehyde, allyl alcohol, OEt·CMe:CH_2, OMe·CHMe:CHMe, Et vinyl ether, divinyl ether, furan, vinyl acetate, Me methacrylate, MeCHO, $COMe_2$, and COMeEt have been determined. The CO group conjugates with C:C in the same way and to approx. the same extent as does C:C. Conjugation occurs in C:C·O·C, but not in C:C·C·O. CO_2H does not conjugate with C:C. Tentative vals. for the heat of enolisation are: MeCHO 10,000, $COMe_2$ and COMeEt 11,600 g.-cal. The energy of the H linking in the enolic form of the compounds of the acetoacetic ester type is probably of the order of 10,000 g.-cal. E. S. H.

Conductivity of calcium iodate and its solubility in salt solutions. W. C. A. WISE and C. W. DAVIES (J.C.S., 1938, 273—277).—The conductivity data, obtained at 18°, show that $Ca(IO_3)_2$ is incompletely dissociated, the dissociation const. for $CaIO_3^+$ being 0·13. Salts increase the solubility of $Ca(IO_3)_2$ at 25°, the relative effect of the added salts being: NaCl < KCl < $K_4Fe(CN)_6$ < $MgSO_4$ < Na_2SO_4 < OH·CHPh·CO_2Na. $CaCl_2$ decreases the solubility. Corrections for incomplete dissociation remove the anomalies and a plot of $\frac{1}{3} \times \log [Ca^{\cdot\cdot}][IO_3']^2$ against $\sqrt{I}$ (I = ionic strength) gives a common curve. The dissociation const. of OH·CHPh·CO_2Ca^+ calc. from the solubility data is 0·033—0·036, which agrees with the val. previously obtained by Davies (cf. A., 1938, I, 196).

C. R. H.

Physico-chemical properties of solutions in liquefied gases. XVIII. Electrical conductivity of sodium chloride and potassium nitrate in liquid ammonia at high dilutions. V. A. PLESKOV (J. Phys. Chem. Russ., 1937, **10**, 601—606).—Measurements were made up to 4,000,000 l. per mol.; the conductivity κ for the solvent is $\geq 1\%$ of the κ. The curve Λ–$\sqrt{C}$ agrees with Onsager's equation at $C < 4 \times 10^{-6}$ mol. per l. The limiting Λ at −40° is 298 for NaCl and 329 for KNO_3. J. J. B.

Electrochemical investigation of arsenic and bismuth bromides in a nitrobenzene solution of aluminium bromide, and of thallium bromide in an ethyl bromide solution of aluminium bromide. V. A. PLOTNIKOV and E. J. GORENBEIN (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 249—259).—The sp. conductivity of a $PhNO_2$ solution of $AlBr_3$ decreases with increase in the [$BiBr_3$] or [$AsBr_3$]. That of an EtBr solution of $AlBr_3$ increases with increase in [TlBr]. In the electrolysis of these solutions As, Bi, and Tl separate at the cathode. The decomp. potentials are: $AsBr_3$–$AlBr_3$ in $PhNO_2$, 0·39 v.; $BiBr_3$–$AlBr_3$ in $PhNO_2$, 0·5 v.; TlBr–$AlBr_3$ in EtBr, 1·57 v. H. J. E.

Electrical conductivity of potassium chloride in methyl alcohol–water mixtures. M. K. THOMAS and D. C. MANDEVILLE (Proc. Indian Acad. Sci., 1937, **6**, A, 312—315).—The conductivity of aq. KCl (0·1—0·00005N) decreases with addition of MeOH up to 70—80% and then increases. $\eta_{max.}$ occurs at 50% MeOH; hence factors other than changes in viscosity, probably solvation, influence the conductivity. F. J. L.

Electrical conductivity of the systems I_2–KI and I_2–TlI in the solid state. V. P. TSCHALI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 293—297).—The conductivity of the systems I_2–KI and I_2–TlI in the solid state increases with [I] and has a positive temp. coeff. H. J. E.

Variation of the absolute rates of migration and transport number of electrolytic ions with dilution. N. C. SEN-GUPTA and S. K. MITRA (J. Indian Chem. Soc., 1937, **14**, 645—652).—Data for KCl, KNO_3, and K_2SO_4 (0·04—0·001N) at 35° show that the limiting equations of Onsager are applicable in the most dil. solutions. In 0·005—0·04N solutions the modified Onsager–Fuoss equation holds for Cl′ and approx. for SO_4'', but not for NO_3'. For NO_3' and SO_4'' the transport no. curves reach the limiting slope only at 0·001N; for Cl′ the transport no. is almost const. E. S. H.

Factors affecting the accuracy of transport number determinations. C. S. HOYT (J. Chem.

Educ., 1937, **14**, 472—473).—Practical points are discussed. L. S. T.

Moving-boundary method for the determination of absolute rates of migration and transport numbers of ions. N. C. SEN-GUPTA (J. Indian Chem. Soc., 1937, **14**, 685—700).—The influence of the concn. of indicator ions on the abs. velocity and transport no. of Cl′, NO_3′, and SO_4″ in 0·1N solutions of their K salts has been investigated. Const. vals. are obtained when the indicator is more conc. than is demanded by the theory of Kohlrausch and Weber, but beyond this range the vals. increase as the concn. of the indicator decreases. The concn. adjustments in the indicator solution have been followed potentiometrically and the abs. velocity and transport no. of the indicator ion calc. E. S. H.

Standard potential of the silver–silver azide electrode. A. C. TAYLOR and L. F. NIMS (J. Amer. Chem. Soc., 1938, **60**, 262—264).—The val. derived from e.m.f. measurements of the cell Ag–AgCl|NaCl (*m*)|KCl (satd.)|NaN_3 (*m*)|AgN_3–Ag at 5—45° is given by $E^0 = E^0_{25} - 0{\cdot}000262(t - 25) - 0{\cdot}00000313(t - 25)^2$. The calc. solubility of AgN_3 is $5{\cdot}1 \times 10^{-5}$ mol. per l. at 25°. E. S. H.

Reproducibility and stability of the hydroquinhydrone electrode in phosphate buffers. E. BIILMANN and J. BJERRUM (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 73—74).—At p_H 5·91 and 6·81 the potentials obtained in 1·5—2 hr. agree within 0·25 mv. and are stable for <90 hr. At p_H 7·73 the deviations shown by freshly prepared electrodes are > in acid buffers and the potentials are less stable. C. R. H.

Motor-electric potential. E. NEWBERY and G. A. SMITH (Trans. Electrochem. Soc., 1938, **73**, Preprint 8, 113—133).—The potential changes produced by relative motion between electrode and electrolyte (motor-electric potential) are associated with potential drift, but no direct proportionality exists. The highest vals. are shown by H_2 on bright Pt (>0·5 v.), Ni (>0·25 v.), Fe, Co, and O_2 electrodes. No metal is free from the effect in all electrolytes. It is supposed that a reducing or oxidising atm. is formed close to the electrode surface by chemical action, its formation being favoured by hydration of the ions, and that disturbance of this layer raises the electrode potential in the case of a reducing atm. and lowers it with an oxidising atm. The effect with H_2 and O_2 electrodes is probably due to a change in mechanical condition of the electrode, accelerated by mechanical disturbance, which prevents the electrode from supplying ions at a rate sufficient to maintain the previous state of equilibrium. J. W. S.

Potential differences produced in solutions by ultrasonic waves. A. J. RUTGERS (Physica, 1938, **5**, 46).—P.d. produced by ultrasonic waves in a dialysed AgI sol should be > those for normal electrolytes by a factor of 10^4. The mass of the negative AgI colloidal ion is 5×10^8 times that of the H ion. In normal electrolytes the magnitude of the effect, calc. from the Debye formula, is of the order of 10^{-6} v. and would be difficult to measure. H. J. E.

Oxidation–reduction potentials of compounds of the platinum metals. I. Oxidation–reduction potentials of the systems $[PtX_4]'' + 2X' \rightleftharpoons [PtX_6]'' + 2e$. A. A. GRÜNBERG, B. V. PTITZIN, and V. N. LAVRENTIEV (J. Phys. Chem. Russ., 1937, **10**, 661—676).—Cells of the type Hg|Hg_2Cl_2, saturated KCl|saturated KNO_3|$K_2[PtX_6]$, $K_2[PtX_4]$, 1N-NaCl|Pt + have been examined. The e.m.f. at 25°, referred to a normal H_2 electrode, is 0·758 v. for X = Cl, 0·643 for Br, 0·468 for SCN, and 0·393 for I. The potentials seem to depend not only on the ratio $[PtX_4]/[PtX_6]$, but also on the concn. of free X_2 mols.; the presence of I_2 in an aq. solution of $K_2[PtI_6]$ could be detected colorimetrically. J. J. B.

Oxidation–reduction potential of cytochrome from bakers' yeast. G. DE TŒUF (J. Chim. phys., 1937, **34**, 740—755).—The boiled plasmolysate of bakers' yeast contains only the reduced form of cytochrome *C*. The reducing power is diminished by washing with H_2O. Colorimetric measurements lead to a val. of rH_2 between 18·3 and 19·9. F. L. U.

Redox potential of lactate–pyruvate system. S. C. GANGULI (J. Indian Chem. Soc., 1937, **14**, 656—659).—Measurements of the electro-reduction of pyruvic acid in absence of O_2 at a Hg or Pt cathode give the val. +0·325 v. at 30°. E. S. H.

Influence of substitution on reduction potential, dissociation constants, and surface activity of phenylarsinic acid.—See A., 1938, II, 118.

Polarographic studies with the dropping mercury cathode. LXXI. Empirical study of the factors of the diffusion current. J. MAAS (Coll. Czech. Chem. Comm., 1938, **10**, 42—53).—Current–voltage curves for 5×10^{-3}, 5×10^{-4} and 10^{-4}N-$CdSO_4$ in 0·1N-KCl show that if the drop time (*t*) is >4 sec. the diffusion current (*i*) $\propto$ [$CdSO_4$]. For vals. of *t* between 5 and 6 sec. the relation $i = 59{\cdot}4m^{\frac{1}{3}}.t^{\frac{1}{6}}$ gives the connexion between *i* and *m* (the rate of flow) in agreement with Ilkovič (A., 1935, 305). F. R. G.

Influence of CN′ concentration on the magnitude of the potential of deposition of Ni·· at a dropping mercury cathode, and on the height of the diffusion wave of the latter. J. P. GOCHSCHTEIN (J. Gen. Chem. Russ., 1937, **7**, 2486—2489).—The deposition potential of Ni from aq. $K_2Ni(CN)_4$ becomes more positive as [CN′] rises; the effect is ascribed to sp. adsorption of CN′ by Hg. R. T.

Platinum electrode. VI. B. ERSCHLER, G. DEBORIN, and A. FRUMKIN (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1065—1073).—The amount of readily removable H on a Pt surface falls to about 40% of the initial amount when the Pt is heated in a H_2 atm., and at the same time a small amount of very firmly bound H appears. Poisoning with As causes an abrupt fall in the absorptive capacity for H_2, and in the cathode potential at which oxidation of the electrode commences. Heating of Pt in O_2 at 900° for 10 sec. leads to formation of a mono-layer of O_2, whilst with more prolonged heating the adsorption layer becomes several atoms thick, and reversion of adsorption is less readily achieved.

Oxidation by atm. O_2 of an electrolytically reduced Pt electrode is most rapid at $p_H > 7$. R. T.

Oscillographic study of anodic current on hydrogen electrode of nickel. G. OKAMOTO and T. IIJIMA (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1426—1436).—The anodic current (I) of a Ni H_2 electrode has been studied by means of an oscillograph at 26° and 50°. When the positive polarisation in the steady state is suddenly increased I decreases suddenly at first and then reaches a steady val. It is inferred that H_2 is first dissociatively adsorbed and that the H atoms are then ionised, the first process being rate-determining. The initial steep descent of I is due to the rapid decrease of adsorbed atoms and the later slow decrease is ascribed to diffusion from the reservoir of occluded H atoms in the electrode. The no. of centres of H adsorption is approx. 10^{13} per sq. cm., and the heat of activation of the adsorbed H atom is 16·6 kg.-cal. per g.-mol. R. S. B.

Theory of the hydrogen overvoltage. A. FRUMKIN (J. Phys. Chem. Russ., 1937, **10**, 568—574).—The formation of H_2 occurs in two steps, viz., (1) metal + $H_3O^+ \rightarrow$ metal–H + H_2O, and (2) metal–H + $H_3O^+ \rightarrow$ metal + H_2O + H_2. On metals which readily adsorb H_2 the second reaction is slow and determines the overvoltage; on metals like Hg the decomp. of metal–H compound is rapid, and the overvoltage is due to the slowness of the first reaction. J. J. B.

Hydrogen overvoltage and ζ-potential. II. S. LEVINA and V. ZARINSKI (J. Phys. Chem. Russ., 1937, **10**, 586—592; cf. A., 1937, I, 521).—The overvoltage on a resting Hg cathode in aq. HCl does not depend on [HCl] between 10^{-3} and 10^{-1}N but increases on addition of $LaCl_3$; this exceeds 0·1 v. when 10^{-3} mol. $LaCl_3$ is added to 10^{-3} mol. HCl. The results are discussed on the assumption that the overvoltage is connected with the electro-osmotic potential. J. J. B.

Electrolysis of metallic perchlorates in Cellosolve. J. L. BEAL and C. A. MANN (J. Physical Chem., 1938, **42**, 283—300; cf. A., 1931, 1130).—Cathode potential–c.d. curves are given for solutions of $AgClO_4$, $Pb(ClO_4)_2$, $Zn(ClO_4)_2,6H_2O$, $Ba(ClO_4)_2$, and $Al(ClO_4)_3$ in OH·$[CH_2]_2$·OEt (I). Evidence of deposition was obtained for all the metals except Al. Solubilities and conductivities of the Ag, Ba, and Pb salts are recorded. The dielectric const. of (I) is 29·6 ± 0·1. F. L. U.

Electrometry and ultra-violet spectrography of rhodizonic acid.—See A., 1938, II, 147.

Passivity of iron and steel in nitric acid solution. XXII. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 87—125; cf. A., 1937, I, 620).—High-C steels become passive more readily than low-C steels, and grey cast Fe still more readily. The low-C steels lose their passivity at 70—80°; the high-C steels and grey cast Fe retain it up to 90°. It is suggested that the presence of graphite favours passivity by forming a residue which retains the corrosion product on the surface. F. J. G.

Certain hypotheses and laws of colloid electrochemistry. V. A. KISTIAKOVSKI (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1049—1063).—A discussion, dealing chiefly with corrosion of metals. R. T.

Ionisation produced from the evaporation of water. E. MEDI (Atti R. Accad. Lincei, 1937, [vi], **26**, 159—165).—Experiments are described which show that in the rapid evaporation of H_2O the surrounding atm. becomes positively charged. O. J. W.

Kinetics of the oxidation of hydrides in the gas phase. IV. Oxidation of arsine. P. S. SCHANTOROVITSCH (J. Phys. Chem. Russ., 1937, **10**, 700—711).—At 50° mixtures of $2AsH_3 + 3O_2$ react only if the pressure rises above a min., p_K cm. Hg. For vessels of various diameters, d cm., $p_K d = 1430$. For different temp. T, $\log p_K = A/T - B$, A being 1016 and B 6·0; the same equation holds for the lower limit of the explosion range, A being 2560 and B 3·7. Reactions started at a pressure $> p_K$ stop before p_K is reached; this poisoning is due to reaction products (As and an AsH_3 hydrate in addition to As_2O_3). The results agree with the theory of branched chain reactions. J. J. B.

Study of the oxy-coal gas flame by band spectra. N. R. TAWDE and J. M. PATEL (J. Univ. Bombay, 1937, **6**, Part II, 29—49).—A detailed account of previous work (A., 1938, I, 85). Gross intensities for the Swan system are recorded, and the transition probabilities are calc.; the results are in agreement with the max. transition probabilities derived from Rydberg's formula. The centres of intensity, intensity distributions, and calc. flame temp. are discussed. A. J. E. W.

Explosion ranges of gas mixtures. IV. Explosion ranges of acetylene–air mixtures. R. BRESKER, M. RIVIN, and I. A. SOKOLIK. **V. Detonation ranges of hydrocarbon–air mixtures.** M. RIVIN and I. A. SOKOLIK (J. Phys. Chem. Russ., 1937, **10**, 688—691, 692—699).—IV. The C_2H_2 flame can change into an explosion wave when the pressure of the C_2H_2–air mixture is not too low; the min. pressure depends on $[C_2H_2]$ and is min. at 8·5 and 12% C_2H_2. The first min. corresponds approx. with the highest temp. of the flame.

V. The flames of Et_2O, C_5H_{12}, or light petroleum (b.p. 35—38°) do not change into an explosion wave. A detonation of a $H_2 + O_2$ mixture produces an explosion wave in mixtures containing 1·8—3% of light petroleum, 5·5—11·5% of C_2H_4, or CO + small amounts of H_2 or C_2H_2. CO + air, C_2H_6 + air, and light petroleum + 5% CO_2 + air do not explode. $PbEt_4$ does not affect the detonation range of light petroleum–air mixtures. As in the internal-combustion engine mixtures "knock" which do not detonate in the experimental tube, a chemical change seems to take place in the cylinder during the compression of the fuel–air mixture. J. J. B.

Kinetics of the reaction $H + C_2H_6 = CH_4 + CH_3$. E. W. R. STEACIE (J. Chem. Physics, 1938, **6**, 37—40).—In a previous paper (A., 1936, 1344) Steacie and Phillips assumed that CH_4 formation in this reaction was negligible but subsequent work by Taylor *et al.* (A., 1937, i, 313) contradicted this view. The reaction has been re-investigated by the

discharge tube method. Taylor's mechanism is confirmed and the energy of activation is 8·6 kg.-cal. in agreement with Taylor's val. Recalculation of the energy of activation of the reaction $D + C_2H_6 = HD + C_2H_5$ yields a val. practically the same as that given by Steacie and Phillips (*loc. cit.*). There still remain certain discrepancies between the two sets of data which cannot be completely explained. W. R. A.

Kinetics of oxidation and inflammability of hydrocarbons. II. Effect of chemically inert gases on speed of oxidation and inflammability of *n*-pentane–oxygen mixtures between 250° and 560°. M. PRETTRE (Ann. Off. nat. Comb. liq., 1937, **12**, 411—446; cf. A., 1937, I, 86).—At any pressure between 100 and 750 mm. and <300° addition of an inert gas (N_2 or A) increases the speed of slow oxidation and promotes flame formation. During the initial period of accceleration the speed, W, of the slow reaction as a function of the time, t, conforms with the law for processes involving frequently branched chains. Thus, $W \propto A.e^{\phi t}$, where A is a const., and $\varphi = kP_cP_t^2(1 + aP_i/P_t)$, where a and k are const., and P_c, P_t, and P_i are respectively the partial pressures of the C_5H_{12}, the sum of the pressures of C_5H_{12} and O_2, and the pressure of the inert gas. The production of flame when it occurs takes place in the time τ defined by $\phi\tau$ = const., or even more rapidly than indicated by this expression. The delay is greatly reduced when the pressure of the inert gas is raised. A is a better accelerator than N_2. Given a sufficient high pressure of C_5H_{12} and O_2 it is probable that the above law is applicable at all temp. At >300—320° and at 100—300 mm. pressure addition of inert gas retards oxidation and inhibits flame formation. R. B. C.

Spontaneous ignition under pressure of typical knocking and non-knocking fuels: heptane, octane; *iso*octane, di*iso*propyl ether, acetone, benzene. M. MACCORMAC and D. T. A. TOWNEND (J.C.S., 1938, 238—246; cf. A., 1937, I, 247).—The general relationships between spontaneous ignition pressures of air–fuel mixtures and the known knock ratings have been substantiated. The ignition of *iso*octane occurs at much higher pressures than that of octane, only one pressure min. being observed. The ignition point curve for Pr^{β}_2O resembles that of Et_2O, although much higher pressures are required over the entire temp. range; the cool flame zones show a dual character. $COMe_2$ gives cool flames and a lower ignition system if pressures are sufficiently high; with C_6H_6 there is no indication of such a system. M. R.

Rate of ethylene polymerisation.—See A., 1938, II, 121.

Kinetics of the halogenate–halide reactions in heavy water. E. ABEL and F. FABIAN (Monatsh., 1938, **71**, 153—174).—Kinetic data are recorded for the reaction of $BrO_3' + Br'$, $BrO_3' + Cl'$, $BrO_3' + I'$, $IO_3' + Br'$, $IO_3' + I'$, and $IO_3' + Cl'$ in H_2O and D_2O. The reactions are faster in D_2O. The relative increase in rate on replacing H by D is greater for IO_3' than for BrO_3'. The results are compatible with the intermediate and rate-determining formation of H_2BrXO_3 (or D_2BrXO_3) and H_2IXO_3 (or D_2IXO_3), where X = another halogen. H. J. E.

Mechanism of complicated hydrolytic reactions. K. F. JAHR (Stiasny Festschr., 1937, 149—177).—In solutions of many multivalent inorg. salts, weak acids, and bases, the rapid hydrolytic reactions are acompanied by secondary, slow reactions in which the products of the primary hydrolysis coalesce to form products of high mol. wt. The application of the law of mass action is difficult, if not impossible. These reactions are explained by a series of independent, direct experimental methods. The hydrolysis of salts of weak, polybasic acids leads to "*iso*polyacids," which can exist only in a narrow region of [H·], whilst that of salts of weaker, polyacid bases is characterised by "*iso*polybases," which can exist together in broad regions of [H·]. Different types of aggregation and condensation reactions are discussed fully with reference to the influence of concn., the [H·], the base, acido-complexes and complex anions, *e.g.*, tungstates and $Fe(ClO_4)_3$. D. B.

Kinetics of reactions of cyanogen halides with bases in aqueous solution. R. O. GRIFFITH, R. S. JOBIN, and A. MCKEOWN (Trans. Faraday Soc., 1938, **34**, 316—325).—The kinetics have been studied and the crit. increments determined for the following reactions in aq. solution: CNI with OH', NH_3, NH_2Me, $NHMe_2$, NMe_3, NH_2Et, $NHEt_2$, NEt_3, and triethanolamine; CNBr with OH', CO_3'', NH_3, NH_2Me, NH_2Et, and triethanolamine. The reactions are of second order with the steric factor of the simple collision theory approx. unity. The sp. reaction rate varies fairly widely according to the base; the CNBr reactions are faster than the corresponding CNI reactions, the ratio of the rates at 10° ranging from about 100 to 900, but the crit. increments of the CNBr reactions are < those of the corresponding CNI reactions by 2000—4000 g.-cal. The velocity coeffs. bear no simple relation to the strength of the base. E. S. H.

Critical increment of ionic reactions. II. Influence of dielectric constant and ionic strength. W. J. SVIRBELY and A. SCHRAMM (J. Amer. Chem. Soc., 1938, **60**, 330—334; cf. A., 1935, 1464).—The rate of the reaction $NH_4CNO \rightarrow CO(NH_2)_2$ has been studied at 30—60° in MeOH–H_2O mixtures at fixed dielectric consts. of 50, 45, 40, and 35, and also in 28·3% aq. MeOH, the dielectric const. of which was varied by rise of temp. The val. of the collision factor Z in the Arrhenius equation is independent of dielectric const. and ionic strength in MeOH–H_2O of const. dielectric const., but varies with the media and with ionic strength in MeOH–H_2O of const. composition. The experimental crit. increments are compared with vals. predicted by theory. E. S. H.

Effect of various factors on the formation of ammonia by boiling proteins with potash. G. LAUDE (Compt. rend., 1938, **206**, 259—261; cf. A., 1937, II, 357).—The rate of hydrolysis of gelatin depends on the [KOH] and for any given [KOH], the rate of hydrolysis ∝ gelatin concn. J. L. D.

Kinetics of iodine addition to olefinic compounds. N. J. BYTHELL and P. W. ROBERTSON

(J.C.S., 1938, 179—183).—The reactions between I_2 and allyl alcohol, acetate, benzoate, and bromide, and undecenoic acid are homogeneous and termol. in AcOH and $PhNO_2$, with low energies of activation. In the non-polar CCl_4 and C_6H_{14}, reactions are heterogeneous, the reacting surface film becoming unstable below limiting concn. and above limiting temp.; pseudo-unimol. coeffs. may be obtained with the unsaturated compound in excess. Relative rates in different solvents indicate that the I_2 mol. becomes polarised immediately prior to addition by impact with the surface film. Under non-heterogeneous conditions, relative rates are in accordance with electronic and constitutive considerations. M. R.

Functional relation between the constants of the Arrhenius equation. Solvent effects in a Diels–Alder addition. R. A. FAIRCLOUGH and C. N. HINSHELWOOD (J.C.S., 1938, 236—238; cf. A., 1937, I, 313).—Velocity coeffs. and energies of activation in the temp. range 10—50° have been determined for the condensation of *cyclo*pentadiene with benzoquinone in various polar and non-polar solvents. Superimposed on the general correlation between log PZ and E is a tendency for E to increase in the polar solvents, an increase in PZ for const. E being found; in view of the very low polarity of the reaction product, the effect cannot be due wholly to an increase in P brought about by the stabilisation of the product, but may involve also a change in the collision frequency. M. R.

Aliphatic substitution and the Walden inversion. III.—See A., 1938, II, 124.

Interaction of hydrogen and deuterium on zinc oxide. E. A. SMITH and H. S. TAYLOR (J. Amer. Chem. Soc., 1938, **60**, 362—371).—Kinetic studies of the reaction $H_2 + D_2 \rightarrow 2HD$ at a ZnO surface at 140—491° K. show the reaction to be of the first order. Apparent activation energies have been calc. from the temp. coeff.; the vals. are low at low temp., but reach 7—8 kg.-cal. at 195—329° K. and about 12 kg.-cal. at 353—491° K. An activated adsorption characterised by a very small val. for E is responsible for the reaction. In the range 383—457° K. and especially 405—430° K. the reaction has an abnormal temp. coeff., which is explained on the basis of a decrease in the active surface covered with rise of temp. Preferential adsorption of D_2 was observed at low temp. and ortho–para H conversion noted at $<140°$ K. E. S. H.

Influence of method of preparation of zinc oxide on the velocity of its dissolution in acids. J. KAMECKI [with J. DOBROWOLSKI] (Rocz. Chem., 1937, **17**, 657—665).—The rate of dissolution in 0·1N-H_2SO_4, -HNO_3, and -AcOH of ZnO prepared under identical thermal conditions from $Zn(NO_3)_2$, $ZnSO_4$, and $Zn(OAc)_2$ varies inversely with the size of the particles, which are smallest for $Zn(OAc)_2$, and greatest for $Zn(NO_3)_2$. R. T.

Heterogeneous reactions in the liquid phase. Reaction between copper and a solution of sulphur in carbon tetrachloride. R. S. BRADLEY (Trans. Faraday Soc., 1938, **34**, 278—281).—The reaction is unimol.; the rate has been determined at 25°, 30°, 35°, and 39°. A large discrepancy between the observed rate and that calc. from kinetic theory is noted. E. S. H.

Velocity of dissolution of gold in cyanide solutions, in relation to the composition of the liquid phase. Influence of sodium and calcium hydroxide, and of complex cyanides of zinc, copper, and iron. I. N. PLAKSIN and N. A. SUVOROVSKAJA (Ann. Sect. Anal. Phys. Chim., 1938, **10**, 187—209).—The velocity of dissolution of Au or Au–Ag in aq. NaCN is diminished in presence of cupri-, zinci-, and ferro-cyanides, or of NaOH or $Ca(OH)_2$; the effect is due to formation of relatively impermeable films on the metal surface. R. T.

Rate of dissolution of lead in acids. II. G. TEDESCHI (Atti R. Accad. Lincei, 1937, [vi], **26**, 176—179; cf. A., 1938, I, 36).—Spongy Pb dissolves in HCl solutions with a measurable rate, which increases rapidly with [HCl]. With [HCl] $> 2·5$N the rate $\propto$ [HCl]^4. The temp. coeff. of the reaction is of the same order of magnitude as that of chemical reactions, and the energy of activation is 11880 ± 400 g.-cal. O. J. W.

Influence of water vapour on the rate of reduction of magnetite and hæmatite by hydrogen. E. P. TATIEVSKAJA and G. I. TSCHUFAROV (J. Phys. Chem. Russ., 1937, **10**, 747—759).—The reduction is retarded by H_2O vapour the more strongly, the lower is the temp.; *e.g.*, the relation of the rates without and with 4% H_2O at 400°, 500°, and 900° is 2·4 : 1·5 : 1·2. The reduction of magnetite stops when [H_2O] reaches the equilibrium val., and that of hæmatite at 400° and 500° ceases at smaller [H_2O], presumably because of adsorption of H_2O on active centres. In absence of H_2O the rate is almost $\propto$ [H_2] up to 0·2 mm. Hg. J. J. B.

Mechanism of the oxidation of carbon monoxide by MnO_2. V. Kinetics of the oxidation of CO by MnO_2 at pressures above 30 mm. S. J. JELOVITSCH and S. Z. ROGINSKI (J. Phys. Chem. Russ., 1937, **10**, 677—687).—The rate of formation of CO_2, dq/dt, has been measured between −39° and 17° and between 30 and 500 mm. It is approx. $\propto$ [CO] and almost independent of [O_2]. It rises with temp.; the heat of activation is 6 kg.-cal. In the course of one experiment $dq/dt = ae^{-\alpha q}$, a and α being const.; this equation agrees with that of the activated adsorption (cf. A., 1935, 942). The effect of the pre-treatment of the catalyst has been investigated. J. J. B.

Rate of reaction of amalgams with acids. II. Sodium amalgams. W. G. DUNNING and M. KILPATRICK (J. Physical Chem., 1938, **42**, 215—228; cf. A., 1938, I, 148).—The reaction with H_2O or aq. NaH_2PO_4 is $\propto$ [Na]^s[acid]^s (surface), and independent of [H^+]. In presence of O_2, the H_2O_2 formed reacts with the amalgam, and this leads to lack of reproducibility in the rate. With strong acids (HCl, $HClO_4$), HCO_2H, AcOH, $EtCO_2H$, $OH·CH_2·CO_2H$, $CH_2Ph·CO_2H$, and $OH·CHPh·CO_2H$, the rate is $\propto$ [acid]^s, but is independent of [Na] when the H_2O reaction is negligible. F. L. U.

Kinetics and mechanism of oxidation–reduction reactions. II. Kinetics of oxidation of arsenious acid by chlorates. A. M. ZANKO and V. F. STEFANOVSKI (J. Gen. Chem. Russ., 1937, **7**, 2385—2397).—The slowest stages of the reaction of oxidation of AsO_2' by ClO_3', in dil. H_2SO_4, are $ClO_3' + AsO_2' \rightarrow ClO_2' + AsO_3'$, and $ClO_3' + Cl' \rightarrow ClO_2' + OCl'$. The reaction is of the autocatalytic type, its velocity being represented by $-d[ClO_3']/dt = k_1[ClO_3'][AsO_2'] + k_2[ClO_3'][Cl']$. In HCl solution the velocity is independent of the $[ClO_3']$ and $[AsO_2']$, but varies parallel with the [HCl]. The velocity in presence of OsO_4 catalyst approx. $\propto [OsO_4]$, but falls with rising $[AsO_2']$, showing that As inactivates the catalyst. R. T.

Acid and basic catalysis in the reaction between dialkyl phosphites and iodine. P. NYLÉN (Z. anorg. Chem., 1938, **235**, 161—182).—The kinetics of the reaction between I and $HPO(OR)_2$ (R = Me, Et, Pr^{α}, Pr^{β}, and Bu^{α}) in aq. solution have been studied at 20° and 30°. With excess of I the rate is unimol. and independent of [I], and remains unchanged when I is replaced by Br, so that the rate-determining step is a tautomeric change of the ester. Salt effects are negligible. In acid solution the reaction is complicated by a simultaneous hydrolysis with the formation of mono-ester. The reaction shows general acid–base catalysis, and the catalytic coeffs. for a no. of acid–base systems have been determined and are discussed in the light of the Brönsted theory. The acidic and basic character of the dialkyl phosphites is discussed and illustrated by conductivity measurements for $HPO(OEt)_2$ in C_5H_5N. F. J. G.

Rapid oxidation of nitrous acid provoked by ascorbic acid. M. LEMOIGNE, P. MONGUILLON, and R. DÉSVEAUX (Compt. rend. Soc. Biol., 1938, **127**, 411—412).—Ascorbic acid spontaneously transforms HNO_2 into NO which is then oxidised to HNO_3. 90% of the original N can be recovered as NHO_3. H. G. R.

Influence of hydrogen-ion concentration on oxidation of ferrous salts. I. F. KARPOVA (J. Gen. Chem. Russ., 1937, **7**, 2613—2619).—The velocity of oxidation of $FeSO_4$ is > that of $(NH_4)_2SO_4,FeSO_4$ solutions, and rises with increasing concn. and p_H of the solutions. Hydrolysis of the salts, with production of $Fe(OH)_2$, does not take place at $p_H < 4$ in absence, and at $< 3{\cdot}2$ in presence, of Fe^{III}. R. T.

Decomposition of diazoacetic ester catalysed by protons and deuterons. II. P. GROSS, H. STEINER, and F. KRAUSS (Trans. Faraday Soc., 1938, **34**, 351—356; cf. A., 1936, 804).—The variation with temp. of the rate of decomp. in D_2O and H_2O has been determined between 0° and 35°. The difference in activation energies is 800 ± 150 g.-cal., which accounts for the three-fold increase of rate in D_2O. E. S. H.

Kinetics of the catalysed polymerisation of styrene. I. Experimental methods and some general features of stannic chloride catalysis. G. WILLIAMS (J.C.S., 1938, 246—253; cf. A., 1937, I, 572).—Both polymeride size (estimated from viscosity measurements) and polymerisation rate (determined by bromination of residual styrene) in CCl_4 solution at 25—45° are more sensitive to change in concn. of styrene than of catalyst; the max. rate approx. $\propto$ the catalyst concn. Induction periods are found for styrene samples which have been kept for some time and contain peroxides; added Bz_2O_2 has no effect on the rate with freshly distilled styrene. M. R.

Acid catalysis in liquid ammonia. I. Ammonolysis of diethyl malonate. C. SLOBUTSKY, L. F. AUDRIETH, and R. W. CAMPBELL (Proc. Nat. Acad. Sci., 1937, **23**, 611—615).—Investigations at 0° show that an increasing concn. of NH_4Cl increases the rate of ammonolysis of $CH_2(CO_2Et)_2$ to $CH_2(CO{\cdot}NH_2)_2$ in a manner analogous to the catalysis of hydrolysis of esters by $H^{\cdot}$. Equiv. concns. of various NH_4 salts are approx. equally effective on the ammonolysis. The $CH_2(CO{\cdot}NH_2)_2$ formed catalyses the reaction, which is thus autocatalytic. Investigations with NH_4Cl at −33° show ammonolysis at a slower rate. N. M. B.

Catalysis, the chemistry of the future. V. N. IPATIEV (Brennstoff-Chem., 1938, **19**, 48—51).—The author's work on catalysis in the field of org. chemistry is briefly reviewed. A. B. M.

Influence of small percentages of certain metals on the dissolution rate of cadmium. M. CENTNERSZWER and F. GONET (J. Amer. Chem. Soc., 1938, **60**, 435—440).—The rate of dissolution of Cd in >5N-HCl is increased by alloying Cd with Pt, slightly increased by alloying with Au, and hardly altered by alloying with Cu. An induction period, which is shorter for higher [HCl] and with increasing Pt content, is observed in the reaction. The rate of dissolution is approx. $\propto$ the increase in [HCl]. Similar experiments in >8N-H_2SO_4 show a decreasing rate of dissolution with increasing $[H_2SO_4]$. Stirring does not influence the rate of dissolution, but shortens the induction period. Comparison of rates at 25° and 40° shows that the rate is controlled partly by diffusion and partly by reaction. E. S. H.

Amorphous and crystallised oxide hydrates and oxides. XXXVIII. Restrictive substances which retard the ageing of and loss of water by röntgenographically amorphous ferric hydroxide gels. A. KRAUSE and B. NIKLEWSKI, jun. (Ber., 1938, **71**, [*B*], 423—429).—The ageing of $Fe(OH)_3$ gels occurs readily in N-NaOH at room temp. and is hindered by the following substances arranged in order of decreasing efficiency: AsO_2', glycerol (and sucrose), SiO_3'', Al''', Zn'', Ba'', VO_4''', Li, B_4O_7'', WO_4'', HPO_3'', PO_4''', MoO_4'', Cr_2O_7'', SeO_3'', CN', Br', Cl', $Na^{\cdot}$. A certain chemical relationship between restrictive agent and gel appears to be the decisive factor. Apart from ageing the gel does not undergo any fundamental change. Absorption of the restrictive agent causes a more or less pronounced "blocking" of the active H in the OH groups whereby the mols. are hindered in the multimol. union necessary for ageing. This effect is so pronounced with $NaAsO_2$ that the catalytic decomp. of H_2O_2 is greatly retarded even when the gel has been washed as far as possible. Other reagents, *e.g.*, glycerol, retard ageing but do not appreciably affect the decomposing action towards

H_2O_2. All the preps., including that treated with AsO_2', retain their power of uniting with Ag. H. W.

Catalysts for the equilibrium, ethylene–water–ethanol.—See A., 1938, II, 121.

Inhibitory action of febrifuges on some oxidation reactions. A. BOUTARIC and J. A. GAUTIER (J. Pharm. Chim., 1938, [viii], **27**, 97—105).—0·2% of aminophenols (I), *p*-OH·C_6H_4·NHMe,H_2SO_4, pyramidone (II), NH_2Ph, cryogenin (III), quinine sulphate (IV), and antipyrine (V) decrease the atm. oxidation of 0·05M aq. PhCHO, but salol and NH_2·CO·NH·NH_2 increase it; 0·5% of *o*-OH·C_6H_4·CO_2H decreases it, but 0·1% increases it. Antipyretics, particularly NHPh·NH_2, (I), (III), and (VI), decrease the rate of oxidation of acidified $FeSO_4$, but strong reducing agents, *e.g.*, (I), have some of their effect by reducing the Fe^{III} formed. Phenacetin, (II), (IV), and (V) increase slightly the rate of oxidation of methylene-blue, but aspirin and (III) decrease it. NH_2Ph and alkaloids decrease the fluorescence of UO_2 salts. R. S. C.

Heterogeneous catalysis. I. Promotion in the conversion of *cyclo*hexane into benzene or methane. A. JULIARD (Bull. Soc. chim. Belg., 1937, **46**, 549—618).—The concurrent reactions: $C_6H_{12} \rightarrow C_6H_6 + 3H_2$ (i); $C_6H_6 + 9H_2 \rightarrow 6CH_4$ (ii) without side reactions at 200—300° in excess of H_2, have been studied with varying temp., speed of gas current, and amount, prep., and dispersion of catalyst (Ni + oxides). Standard technique is developed and applied to the study of promoters on Ni at 300° from activity$_{i,ii}$–molar concn. of promoter curves. Reduced metals (Cu, Cd, Pb, Fe), and, in small crit. %, $CaCO_3$, $BaCO_3$, $SrCO_3$, inhibit strongly; ZnO inhibits (ii) only. Co, Li_2O, K_2O are neutral. The oxide groups: MgO; MnO, ZnO; BeO; and Cr_2O_3, CeO_2, ThO_2, Al_2O_3; show characteristic promoting activity, increasing in this order. Some data for Co are given. The results are interpreted quantitatively on the basis of partial reciprocal activating adsorption in the binary catalyst. I. McA.

Dehydrogenation of methyl alcohol to formaldehyde. V. A. PLOTNIKOV and S. S. BALIASNI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 269—276).—Brass gauze, filings of a Cu–Pb–Sn alloy, and fine granulated Zn were used as catalysts at 400—470°. The CH_2O yield increased with rise in temp., and with decrease in the proportion of MeOH decomposed. H. J. E.

Contact sulphuric acid manufacture.—See B., 1938, 267.

[Catalytic] synthesis of ethyl chloride.—See B., 1938, 251.

Electrolysis with flowing liquid. G. HALLIE (Rec. trav. chim., 1938, **57**, 152—154).—Preliminary. In electrolysis of acetates with the electrolyte flowing past the anode, the vol. of gas liberated at the latter is 95% of the theoretical at room temp., but falls to 33—43% at −25°. At the same time the anode potential shows a sudden rise, oxidation of the AcOH occurs, and the gas contains less C_2H_6 and more CO. The current yield of peroxide is 0·4—0·6% at −10° with *n*-hexoate, and 0·1—0·2% with acetate. Acetate–perchlorate mixtures give rise to $MeClO_4$, and acetate–nitrate mixtures to $MeNO_3$ and MeO·NO. F. L. U.

Anodic oxidation of ammonia to ammonium nitrate.—See B., 1938, 290.

Electrolysis of molten salts. P. DROSSBACH (Z. Elektrochem., 1938, **44**, 124—127).—When $NdCl_3$,2KCl or $CeCl_3$,2KCl is electrolysed at 860° the current efficiencies for the deposition of Nd and Ce, respectively, are 5·2 and 16·4%. Molten $BiCl_3$ yields BiCl at the cathode, but by covering the melt with a layer of NaCl and electrolysing for a long time a deposit of Bi can be obtained with a current efficiency of 49·3% at 340°. Electrolysis of molten $SnCl_2$ yields $SnCl_4$ at the anode and Sn (current efficiency 65·6%) at the cathode. Ca is obtained (current efficiency 34·9%) on prolonged electrolysis of $CaCl_2$ at 850—950°. E. S. H.

Theory of the electrolysis of fused salts. P. DROSSBACH (Z. anorg. Chem., 1938, **235**, 188—192).—Since in many cases the metal has a true solubility in the fused salt, the equilibrium diagram must be taken into account in interpreting the phenomena (preceding abstract). F. J. G.

Influence of cobalt salts on the anodic behaviour of lead in a sulphate electrolyte. M. REY, H. HERBIET, and P. COHEUR (Compt. rend., 1938, **206**, 179—181).—On electrolysis of 10% H_2SO_4, or of 5% aq. $ZnSO_4$ containing 10% H_2SO_4, using a fresh Pb anode and a c.d. of 3 amp. per sq. dm., the electrolyte may ultimately contain up to 7·5 mg. of dissolved and suspended Pb per l. A PbO_2 film is formed on the anode, and suspended PbO_2 appears in the anolyte. Pb in the electrolyte is considerably reduced by 7·5 mg. of Co per l. of electrolyte, whilst higher Co contents (> 50 mg. per l.) suppress the formation of suspended PbO_2 and decrease the film on the anode. Formation of PbO_2 in a bath containing no Co is delayed for some hr. by previously dipping the Pb anode in a solution of a Co salt. These effects are probably due to catalytic decomp. of $Pb(SO_4)_2$ formed at the anode. A. J. E. W.

Formation of pseudo-single crystals in the electrodeposition of copper. O. SCARPA (Atti R. Accad. Lincei, 1937, [vi], **26**, 135—137).—During the electrolysis of strongly acidified $CuSO_4$ solutions with Cu anodes containing S as impurity needle-shaped growths were found on the Cu cathode. Each needle appeared to be a single crystal of Cu, but was found by *X*-ray examination to consist of an aggregate of highly oriented micro-crystals. O. J. W.

Chromium plating from non-chromic acid solutions with chromium anodes.—See B., 1938, 282.

Formation of ozone in an a.c. low-pressure discharge tube. M. SENKUS (Canad. J. Res., 1937, **15**, B, 525—528).—Passage of a glow discharge through O_2 at a pressure of 25 mm. and 17,000 v. apparently produces no O_3, because of deozonisation at the electrodes. D. F. R.

Activation process in reactions in the electric discharge. I. N. I. KOBOZEV, S. S. VASILIEV, and

J. N. JEREMIN (J. Phys. Chem. Russ., 1937, **10**, 543—567).—Equations are given for the reaction kinetics in the discharge. When applied to known reactions they give for the energy of activation vals. which are close to the thermal activation energies of the reactions considered, but distinctly less than the ionisation energies of the mols. involved. Consequently the active particles are mols. and not ions. They are formed in collisions between ions etc. and ordinary mols. The energy spent by the ions etc. in these collisions is subtracted from the light emission energy; in accordance with this view the luminescence of N_2 in its mixtures with O_2 in the discharge decreases with increased gas pressure whilst the rate of oxidation of N_2 increases. J. J. B.

Photodecomposition of chlorine dioxide in carbon tetrachloride solution. J. W. T. SPINKS and H. TAUBE (Canad. J. Res., 1937, **15**, B, 499—524).—Insolation of CCl_4 solutions of ClO_2 initiates a thermal decomp. the magnitude of which may exceed that for the photoreaction with low light intensity. This decomp. is inhibited by keeping the solutions at 3° or by adding H_2O. The photodecomp. at λ 3650 and 4360 A. produces Cl_2O, Cl_2O_6, and Cl_2O_7 as well as Cl_2 and O_2, the quantum efficiency being 2 at λ 3650 A. and 1 at 4360 A. In the Br-sensitised decomp. with λ 5460 A. there is less Cl_2O formed. In the sensitised decomp. the quantum yield is 0·2—0·3; it is independent of $[ClO_2]$ but dependent on the light intensity. D. F. R.

Photochemistry of the earth's atmosphere. W. GROTH and H. SUESS (Naturwiss., 1938, **26**, 77).—The photochemical decomp. of CO_2 ($CO_2 + h\nu = CO + O$) and of H_2O ($H_2O + h\nu = OH + H$) occurs on illumination with the resonance lines of Xe (1470 and 1295 A.). If a mixture of CO_2 and H_2O is thus irradiated the above reactions take place and are followed by reactions between the products [$H + CO (+M) = HCO$; $2HCO = CH_2O + CO$, or $(CHO)_2$], thus giving rise to aldehydes. It is considered that irradiation of $CO_2 + H_2O$ by short-λ ultra-violet light from the sun gave rise to the formation of the O_2 of the atm., and to the production of org. substances. It may also play a part in the CO_2–O_2 balance of the atm. A. J. M.

Nature of silver photohalides and their relations to the latent photographic image. H. SOCHER (Z. wiss. Phot., 1938, **37**, 51—73).—Equilibrium relations between the possible stages of oxidation ($Ag_{met.}$, Ag_2^+, Ag^+) are considered theoretically, allowing for indirect measurement of equilibria from redox potentials on treatment with suitable ferro-ferricitrate (I) mixtures; the influence of particle size and of the gelatin is also discussed. Experiments with various mixtures of Ag halide, Ag photohalide (mixtures of Ag halide sol with Ag sol), with and without gelatin, in equilibrium with different (I) solutions, show, from measurements of equilibrium potentials, that both photohalide and the latent image are composed of two-phase mixtures of Ag halide and Ag. In presence of gelatin, displacements of equilibrium occur which cannot be explained either by an increased solubility of finely-divided Ag or by an influence of gelatin on the solubility of Ag halide. J. L.

Photo-electric behaviour of the recently developed conductor–semi-conductor systems. G. BAIL (Z. Elektrochem., 1938, **44**, 143—151).—The following systems serve as photo-electric cells: Au–ZnO–Cu, Au(Ag)–CdS–Cu, Ag–CuI–Cu, Au–HgI_2–Cu(Zn). Some of the properties of the cells have been investigated. E. S. H.

Photochemical reaction of cellulose.—See B., 1938, 260.

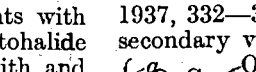
Photosynthesis in *Chlorella*.—See A., 1938, III, 356.

Action of water, hydrogen sulphide, and iodine on sensitive surfaces. G. COSTEANU and P. RENAUD (Compt. rend., 1938, **206**, 252—254; cf. A., 1937, I, 371).—Previous results obtained with H_2O vapour impinging on a Na surface from a capillary jet have been extended; the results are independent of the inclination of the jet to the surface. The area of surface unattacked is increased by keeping the H_2O vapour pressure over the surface low by condensation in liquid air. Unattacked areas surrounding the jet are also obtained with H_2S impinging on $Pb(OAc)_2$, and with I vapour and amalgamated Cu. A. J. E. W.

Sodium fluoroaluminates. V. S. JATLOV (J. Gen. Chem. Russ., 1937, **7**, 2439—2441).—Partial neutralisation of a solution of $Al(OH)_3$ in HF leads to pptn. of a *salt*, $NaAlF_4,H_2O$ (I). Artificial cryolite is usually a mixture of (I) with Na_3AlF_6. The existence of $Na_6Al_2F_{12},7H_2O$ (Baud, A., 1903, ii, 214) is not confirmed. R. T.

Distribution of iodine and bromine in the process of crystallisation of potassium chloride and sodium chloride from aqueous solutions. S. K. TSCHIRKOV and M. S. SCHNEE (Kalii, 1937, **6**, No. 4, 15—26).—The distribution of Br′ and I′ between solid and liquid phases during crystallisation of isomorphous mixtures from aq. solutions at const. temp. has been investigated for the following systems: (*a*) K·–Cl′–Br′–I′–H_2O; (*b*) Na·–Cl′–Br′–I′–H_2O; (*c*) K·–Na·–Cl′–Br′–I′–H_2O. Empirical formulæ are given. D. G.

Action of nitrous acid on solutions of potassium iodide. M. DODÉ (Bull. Soc. chim., 1938, [v], **5**, 64—69).—In the absence of strong mineral acid, HNO_2 reacts with aq. KI thus: $2HNO_2 + KI = KNO_2 + NO + I + H_2O$. The reaction is slow, requiring several hr. at 0° for completion. F. J. G.

Complex copper salts of α-amino-acids. P. PFEIFFER and W. CHRISTELEIT (Stiasny Festschr., 1937, 332—338).—Cu salts in which the Cu possesses secondary valencies of both the 1st and 2nd types,  , are obtained by treatment of the aqueous solutions of the Cu salts of *l*-valine or *iso*leucine with 2 : 2′-dipyridyl or *o*-phenanthroline and pptg. the reaction product with $NaClO_4$.

A corresponding dipyridyl salt of *l*-alanine appears to exist. The rotation dispersion curve of the

dipyridyl–valine–Cu perchlorate is normal and shows no "Cotton effect" corresponding with the symmetrical structure of dipyridyl. [Cu $dipy_3$]$(ClO_4)_2$ and [Cu $phen_3$]$(ClO_4)_2$, in which Cu has 6 co-ordinated valencies, have been prepared. D. B.

Cupritrichlorides and cupritribromides. J. AMIEL (Compt. rend., 1937, **205**, 1400—1403).—The following *compounds* have been prepared: $(XH)_2Cu[CuCl_6]$ (X = $NHMe_2$, NPr_3, C_5H_5N, and piperazine); $(NHMe_2)_2[Cu(H_2O)_4][CuCl_6]$ (I); $(XH)_2Cu[CuBr_6]$ (X = NMe_3 and piporazine). Except for (I), which is green, these compounds form black crystals sol. in $COMe_2$ and alcohols; vals. of ρ for the crystals are given. The compounds are less stable than the cupritetrahalides (A., 1935, 312), and solutions of the cupritrichlorides in the above solvents deposit cupritetrachlorides on addition of Et_2O. The complexes are dissociated in aq. solution. Tho analogy to similar Ni compounds (A., 1936, 194) is noted. A. J. E. W.

Reaction of precipitated silver with aqueous potassium ferricyanide. L. SZNAJDER and J. SZNAJDER (Rocz. Chem., 1937, **17**, 649—656).—0·2M-$K_3Fe(CN)_6$ and freshly pptd. Ag at room temp. yield $Ag_3KFe(CN)_6$. R. T.

Dehydration of magnesium chloride hexahydrate and carnallite. G. GRUBE and W. BRÄUNING (Z. Elektrochem., 1938, **44**, 134—143).—V.-p. curves for $MgCl_2,6H_2O$ at 20—160° have been determined. When log v.p. is plotted against $1/T$, the curve consists of three straight lines, intersecting at 55° and 117°. In the range 55—117° the process $MgCl_2,6H_2O \rightleftharpoons MgCl_2,4H_2O + 2H_2O$ occurs. The subsequent course of dehydration is represented by: $MgCl_2,4H_2O \rightleftharpoons MgCl_2,2H_2O + 2H_2O$, $MgCl_2,2H_2O \rightleftharpoons MgCl_2,H_2O + H_2O$, $MgCl_2,H_2O \rightleftharpoons MgCl_2 + H_2O$, $MgCl_2,H_2O \rightleftharpoons Mg(OH)Cl + HCl$, $MgCl_2,H_2O \rightleftharpoons MgO + 2HCl$. The end product is a mixture of MgO and $MgCl_2$. Similar measurements with carnallite show that between 120° and 140° a transformation occurs in which the H_2O becomes more strongly bound. The course of dehydration is represented by: $KCl,MgCl_2,6H_2O \rightleftharpoons KCl,MgCl_2,2H_2O + 4H_2O$, $KCl,MgCl_2,2H_2O \rightleftharpoons KCl,MgCl_2 + 2H_2O$. E. S. H.

Neutral magnesium chlorocarbonate. (MME.) L. WALTER-LÉVY (Compt. rend., 1937, **205**, 1405—1407; cf. A., 1937, I, 472).—$MgCl_2,MgCO_3,7H_2O$ is slowly pptd. on addition of aq. $Mg(HCO_3)_2$ solution to a conc. aq. $MgCl_2$ solution (3·8—4·8 M.), at room temp. A. J. E. W.

β-Meta-alite. T. YAMAUCHI (J. Japan. Ceram. Assoc., 1937, **45**, 236—240; Zement, 1937, **26**, 778).—The product formed on heating a finely divided mixture of $CaCO_3$ (3 parts) and SiO_2 (1 part) at 1850—1900° gives a distinctive *X*-ray pattern. It may be an unstable form of $3CaO,SiO_2$. G. H. C.

Resolution of co-ordinated inorganic compounds into optical isomerides. II. Co-ordinated zinc compounds with active and racemic propylenediamine. P. NEOGI and K. L. MANDAL (J. Indian Chem. Soc., 1937, **14**, 653—655; cf. A., 1936, 974).—*Zn tripropylenediamine chloride* (I) has been obtained by adding propylenediamine to well-cooled aq. $ZnCl_2$. By treating the conc. solution of (I) with the K salt of the requisite anion, the corresponding *bromide* (II), *iodide* (III), and *thiocyanate* (IV) have been prepared; by using the requisite Ag salt, the corresponding *camphorsulphonate*, *bromocamphorsulphonate*, and *tartrate* have been obtained. Attempts to resolve these racemic compounds have been unsuccessful, but d- and l-*compounds* have been prepared by starting with *d*- and *l*-propylenediamine. In 5% aq. solutions, *d*-(I) gives $[\alpha]_D^{30}$ +44·8°, *d*-(II) +44°, *d*-(III) +38·6°, *d*-(IV) +41°, *l*-(I) −48·5°, *l*-(II) −45°, *l*-(III) −39·2°, *l*-(IV) −43·7°. E. S. H.

Use of high temperatures and high pressures realised in the detonation of explosives for the artificial reproduction of minerals: zincite and willemite. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1938, **206**, 261—263).—After detonation of an explosive in a brass bomb, the temp. and pressure being estimated to attain 4000° and 4000 kg. per sq. cm., followed by prolonged heating at 400°, a deposit of zincite, formed from Zn in the brass, was found on the walls of the bomb. Willemite was similarly obtained by mixing amorphous SiO_2 with the explosive used. A. J. E. W.

Action of nitric acid on mercury. I. M. S. SHAH and B. G. JOSHI (J. Univ. Bombay, 1937, **6**, Part II, 57—74).—HNO_3 free from HNO_2 has no action on Hg. Ordinary HNO_3 reacts, forming $Hg^{\cdot}$, $Hg^{\cdot\cdot}$, and NO_2' in solution, with NO and N_2O_4; the variation of the proportions of these products with [HNO_3], the time of interaction, the temp., and the wt. of Hg taken, has been investigated. The Hg dissolves forming $Hg^{\cdot}$, which is then oxidised to $Hg^{\cdot\cdot}$ with production of NO_2' and NO. Both these stages are accelerated by increasing [HNO_2]. With excess of Hg, cryst. $HgNO_2$ can be separated; decreasing the amount of Hg increases the formation of $Hg^{\cdot\cdot}$. A. J. E. W.

Reaction between aqueous solutions of mercuric chloride and disodium hydrogen phosphate. S. M. MEHTA and S. M. SHETH (J. Univ. Bombay, 1937, **6**, Part II, 75—79).—On first mixing the solutions a yellow ppt., probably a mixture of a Hg phosphate and an oxychloride, is formed; on keeping at 30—40°, reddish-brown $2HgO,HgCl_2$, or at 90° $3HgO,HgCl_2$, is formed. The product is unchanged on varying the p_H of the Na_2HPO_4 solution between 8·655 and 8·92. A. J. E. W.

Transition of the mercuric sulphides in anhydrous hydrogen sulphide in ammonia. G. B. HEISIG (J. Amer. Chem. Soc., 1938, **60**, 359—361).—Black HgS is converted into the red form when sealed in a tube with liquid H_2S. Red HgS reacts with a solution of $(NH_4)_2S$ in liquid NH_3, forming black crystals of $(NH_4)_2S,6HgS$. E. S. H.

Boron hydrides. VIII. Structure of the diammoniate of diborane and its relation to the structure of diborane. H. I. SCHLESINGER and A. B. BURG (J. Amer. Chem. Soc., 1938, **60**, 290—299; cf. A., 1936, 712).—The reaction product of B_2H_6 with NH_3 at −120° undergoes reactions

which show that its structure is given by $NH_4^+[BH_3{\cdot}NH_2{\cdot}BH_3]^-$. B_2H_6 reacts with Me_2O at $< -80°$, yielding Me_2OBH_3, which reacts with NH_3 and Na, forming $NaBH_3NH_2$. When B_2H_6 is passed over its diammoniate at 80° a volatile *compound*, B_2H_7N, is produced. E. S. H.

Dissolution of metals in fused aluminium chloride ammoniates. V. A. PLOTNIKOV and A. J. ROITMANN (Mem. Inst. Chem. Ukrain. Acad. Sci., 1937, **4**, 261—267).—Al and Na replace the H of NH_3 in the ammoniate of $AlCl_3$ as follows: $AlCl_3,NH_3 + Na = AlCl_3,AlN + 1{\cdot}5H_2$: $AlCl_3,NH_3 + 3Na = AlCl_3,Na_3N + 1{\cdot}5H_2$. Bi and K act similarly. The inner structure of the NH_3 mol. is charged by the formation of a complex with $AlCl_3$. H. J. E.

Scandium carbonates. J. S. ŠTĚRBA-BÖHM and J. P. ŠTĚRBA-BÖHM (Coll. Czech. Chem. Comm., 1938, **10**, 8—19).—Contrary to Crookes (A., 1909, ii, 44) Sc does not give a neutral carbonate. Contrary to Meyer *et al.* (A., 1910, ii, 854) the double compounds with $(NH_4)_2CO_3$ and Na_2CO_3 are $NH_4Sc(CO_3)_2$ with 1·5—$2H_2O$ and $Na_5Sc(CO_3)_4$ with 2, 11, and $18H_2O$. $KSc(CO_3)_2,H_2O$ and $K_5Sc(CO_3)_4,5H_2O$ were prepared from Sc formate with $KHCO_3$ and K_2CO_3, respectively. F. R. G.

Metal carbonyls. I. History. II. Preparation. III. Constitution. IV. Properties. W. E. TROUT, jun. (J. Chem. Educ., 1937, **14**, 453—459, 575—581).—Summaries. L. S. T.

New halides of silicon. II. R. SCHWARZ and R. THIEL (Z. anorg. Chem., 1938, **235**, 247—253).—When $SiCl_4$ reacts with H_2 in the hot-and-cold tube the *compound* $Si_{10}Cl_{20}H_2$ is formed as a viscous oil, ρ 2·1. By controlled hydrolysis the *OH-derivatives* $Si_{10}(OH)_{20}H_2$ (I) and $Si_{10}(OH)_{21}H$ are obtained as white solids. (I) is explosive. F. J. G.

Aqueous solutions of bi-, ter-, and quadrivalent titanium. G. PATSCHEKE and W. SCHALLER (Z. anorg. Chem., 1938, **235**, 257—272).—Solutions of Ti in HCl and H_2SO_4, and of TiO in H_2SO_4, contain Ti^{III} and some Ti^{IV} but no Ti^{II}. Solutions of TiO in HCl contain Ti^{III} and smaller amounts of Ti^{II}. Ti^{III} is slowly oxidised in solution in the absence of air, and the oxidation is accelerated by H_2SO_4. $TiCl_2$ in solution is oxidised within 1 hr. at 0° in the absence of air. With KCNS, Ti^{III} gives an intense brown colour in acid solutions only, whereas Ti^{IV} gives a violet colour in acid or neutral solution. The coloured substances are extracted by Et_2O, and the partition coeffs. have been measured. Extraction with Et_2O of a neutral solution containing excess of KCNS affords a quant. separation of Ti^{III} from Ti^{IV}. Ti^{II} is oxidised by KCNS. F. J. G.

Formation reactions of tin and cadmium ferrites. F. REDSLOB and H. FORESTIER (Compt. rend., 1938, **206**, 250—252).—The ppt. obtained from cold aq. $FeCl_3$ and aq. NH_3 gives lepidocrocite (Fe_2O_3,H_2O) (I) on boiling with EtOH or C_5H_5N. Fe_2O_3,CdO and Fe_2O_3,SnO are formed on boiling an EtOH suspension of (I) and $Cd(OH)_2$ or $Sn(OH)_2$ for 1 hr. The ferrites are not ferromagnetic, and are readily hydrolysed to γ-Fe_2O_3 and the hydroxide. A. J. E. W.

Lower oxygen compounds of nitrogen. I. S. MALACHTA (Coll. Czech. Chem. Comm., 1938, **10**, 32—41).—Na nitrohydroxylamate with aq. NH_3 and H_2O gives respectively $Na_2N_2O_3,NH_3,6H_2O$ and $Na_2N_2O_3,H_2O$ which on desiccation at 100° gives an isomeric form of $Na_2N_2O_3$. *Li nitrohydroxylamate* is prepared similarly. F. R. G.

Precipitation of crystals of simple and complex azides. L. ROSENTHALER (Mikrochem., 1938, **23**, 325; cf. A., 1938, I, 157).—Uzel's priority (A., 1930, 1010) is admitted. J. W. S.

Preparation of hypophosphorus acid from P_2I_4 and PI_3. J. H. KOLITOWSKA (Rocz. Chem., 1937, **17**, 616—619).—$H_4P_2O_6$ is obtained from P_2I_4 in 44·6% and from PI_3 in 37·3% yield by the method previously described (A., 1937, I, 195). R. T.

Preparation of hypophosphorus acid from red phosphorus. T. MIŁOBĘDZKI, J. H. KOLITOWSKA, and Z. BERKAN (Rocz. Chem., 1937, **17**, 620—629).—Red P suspended in AcOH–NaOAc buffer at p_H 5·7 is oxidised by I in KI (85% of theory for oxidation of P to P^V), at room temp. The yield of $H_4P_2O_6$ is 33%. R. T.

Obscure reaction of phosphorus trichloride. R. D. COGHILL (J. Amer. Chem. Soc., 1938, **60**, 488).—Attention is directed to the risk of explosion when distilling AcCl from PCl_3 + AcOH, using a free flame. The probable reactions involved are discussed. E. S. H.

Monofluophosphates and their analogy and isomorphism with sulphates. H. C. GOSWAMI (J. Indian Chem. Soc., 1937, **14**, 660—666).—The *compounds* $NiPO_3F,7H_2O$, $CoPO_3F,6H_2O$, $CuPO_3F,5H_2O$, and $ZnPO_3F,5H_2O$ have been prepared by double decomp. of Ag_2PO_3F with the requisite chloride. By crystallisation of mixed solutions the *compounds* $NiPO_3F,(NH_4)_2PO_3F,6H_2O$, $CoPO_3F,(NH_4)_2PO_3F,6H_2O$, $Al_2(PO_3F)_3,(NH_4)_2PO_3F,24H_2O$, and $NiSO_4,(NH_4)_2PO_3F,6H_2O$ have been obtained. All the above salts are isomorphous with the corresponding sulphates. NH_4PO_3F forms mixed crystals with $CoSO_4$, $CuSO_4$, $ZnSO_4$, and $MnSO_4$. E. S. H.

Metaphosphoric acids. II. Physico-chemical properties of the metaphosphoric acids [formed] from crystalline and amorphous P_2O_5. S. GLIXELLI and K. BORATYŃSKI (Z. anorg. Chem., 1938, **235**, 225—241).—Cryst. P_2O_5 prepared by sublimation has ρ^{20} 2·284. The solutions of "HPO_3" prepared from it differ in Λ, $[H^+]$, and f.p. from those prepared from amorphous P_2O_5. The changes in these quantities with time indicate a progressive depolymerisation of $(HPO_3)_x$ followed by hydration to an intermediate product and ultimately to H_3PO_4. The results of the Sabatier titration method and of the colorimetric method for the determination of $[H_3PO_4]$ in these solutions do not agree. F. J. G.

Double-shelled selenato-complexes. H. BRINTZINGER and F. JAHN (Z. anorg. Chem., 1938, **235**, 242—243).—According to the method of dialysis, the selenate ion is SeO_4'' in neutral or acid solution but $[SeO_4(H_2O)_2]''$ in alkaline solution. A no. of chromi-

ammine and cobaltammine cations form complex anions with four selenate ions. F. J. G.

Olation of basic chromic, aluminium, and ferric chloride solutions. B. H. PERKINS and A. W. THOMAS (Stiasny Festschr., 1937, 307—331).—"Olation" is any reaction by which basic salt solutions become more resistant to HCl. An "ol complex" is any basic complex unreactive to HCl. In basic $CrCl_3$ solutions, (1) the % olation (I) is independent of the extent of dilution, (2) boiling and dilution increase the amount of free acid, (3) the val. of (I) found can be corr. for the effect of free acid, (4) conductance titration yields vals. for the basicity which agree with those calc., (5) incorrect basicity results are given by the method involving boiling for 3 hr. with excess of acid, (6) assuming no change in n, the no. of colloidal particles diminishes as (I) is diminished by boiling with HCl. In both basic $CrCl_3$ and $AlCl_3$ solutions, (1) acid in excess of the amount necessary to react with unolated complexes has no immediate effect on ol complexes, (2) the rate at which the aged solutions react with HCl diminishes with age, (3) the rate of production of free acid is measured by conductance titrations over a range of temp. and concn., (4) the velocity of olation (II) increases on increasing the basicity from 20% to 33·3%, (5) (II) and the rate of production of free acid are less with basic $AlCl_3$ than the corresponding basic $CrCl_3$, (6) the effect of temp. and concn. on (II) is studied, (7) there is a similarity to basic $FeCl_3$ as regards change in resistance to HCl on ageing. The above method for measuring the quantity of free acid gives an upper limit and not a correct val. The determining factor is the rate of change of polynuclear complexes from a form in which the hydroxo-groups are reactive to oxonium ion to a form in which they are not. D. B.

Chromium perchlorate, its hydrates and properties. V. BIBER and I. NEIMAN (J. Gen. Chem. Russ., 1937, **7**, 2658—2664).—The prep. of $Cr(ClO_4)_3,9H_2O$ is described, and its solubility, and the d of its solutions, are determined. The hydrates $Cr(ClO_4)_3$,3, 5, 6, and $10H_2O$, are confirmed. R. T.

Reaction products in the thermal decomposition of ammonium chromates. K. FISCHBECK and H. SPINGLER (Z. anorg. Chem., 1938, **235**, 183—187).—The slow decomp. of $(NH_4)_2CrO_4$, $(NH_4)_2Cr_2O_7$, and $(NH_4)_2Cr_3O_{10}$ in vac. at 160—250° yields as gaseous products only N_2, NH_3, and H_2O. The final solid product is Cr_2O_3,H_2O in all cases but $(NH_4)_2Cr_3O_{10}$ yields CrO_2,H_2O at first as an intermediate stage. F. J. G.

Preparation and properties of phosphotungstic acid. E. A. NIKITINA (J. Gen. Chem. Russ., 1937, **7**, 2609—2612).—Drechsel's method (A., 1887, 703) of prep. of phosphotungstic acid is preferred. R. T.

Use of acetyl chloride as a chlorinating agent in inorganic chemistry. A. CHRÉTIEN and G. OECHSEL (Compt. rend., 1938, **206**, 254—256).—Certain metallic oxides on agitation with AcCl in $CHCl_3$ solution, at −60° to 20°, give Ac_2O and a chloride, oxychloride, or additive compound corresponding with the oxide. Suitable apparatus is described, and the mechanism of the process is discussed. UO_3 treated by this method gives UO_2Cl_2,Ac_2O; V_2O_5 and MnO_2 give $VOCl_3$ and $MnCl_4$, respectively. A. J. E. W.

Iodine monochloride. II. Reactions with salts. J. CORNOG, H. W. HORRABIN, and R. A. KARGES (J. Amer. Chem. Soc., 1938, **60**, 429—432; cf. A., 1932, 823).—NH_4, K, Rb, and Cs chlorides form additive compounds of the type MCl,ICl; Li, Na, Ag, Cu, and Ba chlorides do not react with ICl. Na and K nitrates and sulphates yield NaCl and KCl when heated with ICl. NH_4, Cs, K, Cd, Cu, Pb, and Ag cyanides react according to $ICl + MCN = ICN + MCl$. Cyanates and thiocyanates yield $I(CNO)_3$ (decomp. 160°) and $I(CNS)_3$ (decomp. 260°), respectively. Cd, Zn, Pb, and Ag sulphides are converted into iodides. By interaction of ICl with heavy metal acetates in AcOH, the *compounds* $Pb_2(OAc)_2,ICl$, $Cd_3(OAc)_2,2ICl$, and $Cu_2(OAc)_2,ICl$ have been obtained. E. S. H.

Manganese in hydrofluoric acid. S. J. LEWIS (Chem. and Ind., 1938, 190).—Aq. HF, and substances prepared with it, frequently contain traces of Mn. F. L. U.

Complex compounds of manganese. O. E. ZVJAGINTZEV, O. J. MAMULAJSCHVILI, and M. TSCHKONIJA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1255—1259).—The prep. and properties of the salts $MnCl_4,2C_5H_5N$, $MnCl_2,2C_5H_5N$, $Mn(NO_3)_2,2C_5H_5N,2H_2O$, and $MnSO_4,C_5H_5N,H_2SO_4$ are described. R. T.

Corrosion of iron at the boundary metal–liquid–gas and metal–liquid–liquid. M. K. TICHONOV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **17**, 315—317).—A drop of aq. $HgCl_2$ corrodes polished Fe or steel exposed to the atm. with the formation of hydroxide at the periphery and centre. The even distribution of Hg droplets formed during corrosion creates a large no. of local elements on which differential aëration exerts no influence. If, however, C_6H_6 be used as the third phase, instead of air, corrosion is more pronounced at the centre of the drop of $HgCl_2$, with the formation of droplets of Hg and minute bubbles of H_2. The latter carry with them a little solution and start corrosion centres at points away from the drop. The results with C_6H_6 are in accordance with Evans' theory of differential aëration. R. S. B.

Dilatometric study of iron nitride. V. I. PROSVIRIN (Zavod. Lab., 1937, **6**, 1132—1134).—The formation and decomp. of Fe nitrides are studied dilatometrically. R. T.

Active substances. XXVI. Reducibility of α-Fe_2O_3 by vapours of fats and traces of other organic compounds. R. FRICKE and M. KIMMERLE (Ber., 1938, **71**, [*B*], 474—480).—In a closed apparatus α-Fe_2O_3 or γ-Fe_2O_3 is readily reduced with formation of some Fe_3O_4 by min. amounts of org. substances, *e.g.*, minute residues of fat, fine org. dust, vapours of joint or tap fat or from oil pumps. Active α-Fe_2O_3 obtained by dehydrating the hydroxide at a low temp. reacts at a particularly

low temp. The effect is followed by observation of the behaviour towards $KMnO_4$ of α-FeO·OH dehydrated under varied conditions. H. W.

Ruthenium ammines. II. Sulphito-ammines of bivalent ruthenium. Tetrammine series. K. GLEU, W. BREUEL, and K. REHM (Z. anorg. Chem., 1938, **235**, 201—210).—The action of $NaHSO_3$ on $[Ru(NH_3)_5Cl]Cl_2$ yields the *compounds* $Na_4[Ru(NH_3)_2(SO_3)_2(SO_3H)_2],6H_2O$ and $[Ru(NH_3)_4(SO_3H)_2]$ (I). (I) behaves as a dibasic acid and affords the *ammonium salt* $(NH_4)_2[Ru(NH_3)_4(SO_3)_2],4H_2O$. By the action of mineral acids on (I) a no. of *tetrammino-compounds* containing co-ordinated SO_2 can be obtained, viz. $[Ru(NH_3)_4(SO_2)Cl]Cl$, $[Ru(NH_3)_4(SO_2)Cl]SO_4H,2H_2O$ (also *anhyd.*), $[Ru(NH_3)_4(SO_2)Br]Br$, $[Ru(NH_3)_4(H_2O)(SO_2)](NO_3)_2$, $[Ru(NH_3)_4(H_2O)(SO_2)]S_2O_6$. In all these Ru is bivalent. They are all diamagnetic and have the *trans*-configuration. F. J. G.

Ruthenium ammines. III. Sulphito-ammines of bivalent ruthenium. Pentammine series. K. GLEU and W. BREUEL (Z. anorg. Chem., 1938, **235**, 211—219).—When $[Ru(NH_3)_4(SO_2)Cl]Cl$ (cf. preceding abstract) is treated with aq. NH_3 the *compound* $[Ru(NH_3)_5SO_3],2H_2O$ is formed and from it a no. of *pentammino-salts* containing co-ordinated SO_2 can be obtained, viz., $[Ru(NH_3)_5SO_2]Cl_2$, $[Ru(NH_3)_5SO_2]Br_2$, $[Ru(NH_3)_5SO_2](NO_3)_2$, $[Ru(NH_3)_5SO_2]S_2O_6$, $[Ru(NH_3)_5SO_2]SO_4,2H_2O$ (I), $[Ru(NH_3)_5SO_2](SO_4H)_2$ (II), and the *double salt* $[Ru(NH_3)_5SO_2]SO_4,(NH_4)_2SO_4,2H_2O$. (I) and (II) form a complete series of mixed crystals in equilibrium with 0·3N- to 30N-H_2SO_4. In all cases Ru is bivalent and the salts are all diamagnetic. F. J. G.

Structure of β-(*cis*-)diamminoplatinous chloride: evidence based on preparation of the palladochloride. F. W. CHATTAWAY and H. D. K. DREW (J.C.S., 1938, 198—201).—$[Pt(NH_3)_2Cl]_2PdCl_6$ and $[Pt(NH_3)_2]PdCl_4$ have been prepared from the β-compound by means of $PdCl_2$ in HCl solution, the latter being more simply obtained by means of K_2PdCl_4. The structure *cis*-$Pt(NH_3Cl)_2$ is compatible with these reactions, either or both of the Cl atoms being potentially ionisable from the N atom. Under the conditions employed, no reaction was observed with α- or γ-$Pt(NH_3)_2Cl_2$ or with a no. of other α- and β-platinammines. M. R.

Reactions between complex compounds of one and the same metal at different valency levels. A. A. GRÜNBERG and F. M. FILINOV (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 1245—1254).—The equilibrium *cis*- or *trans*-$[Pt(NH_3)_2X_2] + K_2[PtX_6] \rightleftharpoons$ *cis*- or *trans*-$[Pt(NH_3)_2X_4] + K_2[PtX_4]$ established in the cases X = Cl, Br, CNS, or I; the velocity of the reaction rises in the order given. *Compounds* of the type *cis*- or *trans*-$[Pt(NH_3)_2X_2][Pt(NH_3)_2X_4]$ (X = Br, I) are also formed in the above reaction. R. T.

Thiosulphate complexes of bivalent platinum. I. D. I. RJABTSCHIKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 39—42; cf. A., 1936, 428, 1203).—$Na_2S_2O_3$ with $K_2[PtCl_4]$ yields sol. *thiosulphatoplatinite* $M_6[Pt(S_2O_3)_4]$ whence were derived the *Ba*, *Na* $(+6H_2O)$ (I), and *K* salts. The *compound* $[Pt(S_2O_3)_4][Pt(NH_3)_4]_3$, which with Na_2PtCl_4 yields green Magnus salt $[PtCl_4][Pt(NH_3)_4]$ (II), +(I) in solution, is prepared by the action of saturated thiosulphate solution (III) on (II) heated, on $[Pt(C_2O_4)_2][Pt(NH_3)_4]$ cold, or of (I) on $[Pt(NH_3)_4]Cl_2$ (IV). With (IV)-type salts, (III) yields by exchange of outer Cl′ the *compounds* $[Pt(A)_4]S_2O_3$ ($A = NH_3$, C_5H_5N, $0{\cdot}5\{NH_3,S_2O_3\}$, or S_2O_3), before replacement begins in the inner shell. Addition of 1 mol. of (III) to *cis*- and to *trans*-$[Pt(NH_3)_2(NO_3)_2]$ yields the grey non-electrolytic *ppts.* $[(NH_3)_2PtS_2O_3]$ and $[NH_3(S_2O_3)Pt(H_2O)NH_3]$, which dissolve in another mol. to cis- and trans-$Na_2[Pt(NH_3)_2(S_2O_3)_2]$ (V); these are pptd. by (IV) as the dimeride $[Pt(NH_3)_2(S_2O_3)_2][Pt(NH_3)_4]$. Further $Na_2S_2O_3$ acts only on the *cis*-form of (V), yielding (I). The results are discussed. I. McA.

Salt error and other errors in colorimetric p_H determination. C. DU RIETZ (Svensk Kem. Tidskr., 1938, **50**, 13—27; cf. A., 1938, I, 94).—The influence of the salt effect on the accuracy of indicators is treated theoretically. 15 sulphonephthalein indicators have been studied in a wide variety of solutions and the salt errors determined. Errors due to EtOH, proteins, colloids, and the dissociation of the indicator itself in weakly buffered solutions are discussed. M. H. M. A.

Rubrophen as an indicator in acid and base determination. L. SZEBELLÉDY and N. AJTAI (Pharm. Zentr., 1938, **79**, 33—34).—This $CHPh_3$ dye shows two marked colour changes between p_H 1—3 and 6—8, *i.e.*, from cherry-red to yellow and from orange-yellow to violet, respectively. E. H. S.

Application of mixed indicators to acidimetric titration of dilute and coloured solutions. R. C. BURSCHTEIN (Zavod. Lab., 1937, **6**, 825—826).—A mixed fluorescein–Me-orange indicator is used in titration of acids, when a green fluorescence appears at the end-point, which is the same as with Me-orange alone. R. T.

Sensitive methods for the detection of hydrogen peroxide and its formation during certain processes of dehydrogenation. O. SCHALES (Ber., 1938, **71**, [*B*], 447—460).—Phenolphthalein (I) is reduced by Zn dust and alkali to colourless phenolphthalin, re-oxidised by H_2O_2 to (I). Under suitable conditions H_2O_2 can thus be detected at a dilution of 1 in 10^8. In coloured solutions in which the colour of (I) is masked its presence is readily detected spectroscopically by the characteristic green band. In acid solution the presence of (I) is detected by addition of alkali at the conclusion of the experiment. Fluorescin is not a very suitable reagent as it is comparatively rapidly re-oxidised when kept. H_2O-sol. *c*-hæmin is advantageously used as catalyst in the detection of H_2O_2 by the luminescence of luminol (3-aminophthalhydrazide). Specht's luminol reagent exhibits distinct luminescense. It is not completely sp. for traces of blood since the reaction is inhibited by $Cu^{\cdot\cdot}$, $Co^{\cdot\cdot}$, and $Mn^{\cdot\cdot}$. The blood is itself degraded so that, contrary to Specht, subsequent spectroscopic

investigation is not possible if only traces of blood are available. With these reagents the production of H_2O_2 is established when O_2 is passed through solutions of ascorbic acid, $SH{\cdot}CH_2{\cdot}CO_2H$, cysteine, glutathione, H_2S, $Na_2S_2O_4$, N_2H_4, and adrenaline. H. W.

Micro-determination of halogens and sulphur by Carius' method. C. TIEDCKE (Mikrochem., 1938, **23**, 301—304).—Methods are suggested for avoiding error through adherence of $BaSO_4$ to the walls of the tube and through material being swept out mechanically during the release of pressure. J. W. S.

Demonstration of the necessity for care in sampling [in analysis]. B. L. HERRINGTON (J. Chem. Educ., 1937, **14**, 544).—Data showing wide divergences in results for the determination of Cl′ in mixtures of a chloride + sucrose owing to inefficient sampling are recorded. L. S. T.

Analysis of mixtures of chlorine, phosgene, and nitrosyl chloride. E. W. R. STEACIE and W. McF. SMITH (Canad. J. Res., 1938, **16**, B, 1—5).—The method is based on the behaviour of these gases towards Hg; $COCl_2$ is inert, Cl_2 is completely absorbed, and NOCl yields an equimol. amount of NO. Apparatus, procedure, and a test of the method, are described. When NO_2 is present the method is satisfactory only for mixtures of NOCl, $COCl_2$, and NO_2 or $COCl_2$, Cl_2, and NO_2. L. S. T.

Determination of free chlorine in potable water.—See B., 1938, 325.

Determination of bromine in phosphorus tribromide. R. I. ALEXEEV (Zavod. Lab., 1937, **6**, 816—818).—0·35 ml. of PBr_3 are added to 35 ml. of NaOH, followed by H_2O to 200 ml., and the solution is boiled for 30 min. with 50 ml. of 1·2% $KMnO_4$. 30 ml. of 7% Na_2SO_3 are added, to remove excess of $KMnO_4$ as MnO_2, when 5 ml. of starch solution and 0·3 ml. of 0·1N-KI are added, followed by 25 ml. of HNO_3, to dissolve the MnO_2. A slight excess of $KMnO_4$ is added, and the solution is decolorised with 0·1N-Na_2SO_3; 30 ml. of 8% $AgNO_3$ are added, and the solution is boiled, left overnight, and filtered. The ppt. of AgBr + AgCl + AgI is washed, dried at 130°, and weighed. The wt. of AgI formed from the KI added is deducted (0·00705 g.), and the wt. of AgCl is calc. from the Cl content, as determined by a modification of Berg's method (A., 1927, 35). R. T.

Analysis of tincture of iodine.—See B., 1938, 318.

Determination of fluorine in presence of amorphous silicic acid. G. A. MARKOVA (Zavod. Lab., 1937, **6**, 807—811).—Trustworthy results are given by Willard and Winter's method (A., 1933, 242). R. T.

Methyl-red as an indicator for titration of fluorine with thorium salts. V. A. ZACHAREVSKI (Zavod. Lab., 1937, **6**, 1019—1020).—Fluorides are titrated with $Th(NO_3)_4$ in presence of Me-red. R. T.

Use of gelatin in the gravimetric determination of fluorine as calcium fluoride. N. F. MICHAILOVA (Zavod. Lab., 1937, **6**, 1154).—Suspensions of CaF_2 are flocculated by addition of gelatin, when they are readily filterable. R. T.

Hydrolysis coefficient of the silicofluoride ion, and the potentiometric titration of fluorides with calcium nitrate in presence of silicofluoride. (A) I. G. RISS. (B) N. V. ILJIN (Zavod. Lab., 1937, **6**, 1163—1165, 1165—1167).—(A) Polemical, in reply to Iljin (*ibid.*, 521). (B) A reply. R. T.

Rapid determination of atmospheric oxygen. A. KLING (Bull. Acad. Méd., 1938, **119**, 178—182).—Fe^{II} tartrate, made alkaline before use, is employed as a reagent with methylene-blue as indicator. With 13—21 vol.-% of O_2, the error is $\gtrless$0·5%. A simple apparatus is described. B. K.

Colorimetric determination of dissolved oxygen in water.—See B., 1938, 325.

Bromometry. I. Determination of thiocyanic acid, arsenious acid, and antimony. T. NAKAZONO and S. INOKO (Sci. Rep. Tôhoku, 1937, **26**, 303—312).—The optimum vals. of the [HCl] in the direct titration of HCNS, $HAsO_2$, and $SbCl_3$ with $KBrO_3$, using Me-orange as indicator, are 0·3—0·6N, 0·3—2·0N, and 1·3—2·0N, respectively. For the potentiometric method these concn. ranges are extended to 0·3—3·0N, 0·3—6·0N, and 1·3—6·0N, respectively, but the change in e.m.f. at the end-point decreases with increasing [HCl]. J. W. S.

Colorimetric determination of oxides of nitrogen. M. L. VARLAMOV (Zavod. Lab., 1937, **6**, 1070—1074). R. T.

Detection of nitrates with rubrophen. L. SZEBELLÉDY and J. JÓNÁS (Pharm. Zentr., 1938, **79**, 51—53).—A solution of rubrophen in H_2SO_4 is decolorised by nitrates. Using KNO_3 solution alone, the limiting [NO_3′] detectable was 1 in 5×10^4 and the presence of most cations or SO_4'', PO_4''', BO_3''', or Cl′ did not interfere. E. H. S.

Determination of ammonia in drinking water.—See B., 1938, 325.

Hydration of diammonium dihydrogen pyrophosphite to orthophosphite at 30°. S. J. KIEHL and M. F. MOOSE (J. Amer. Chem. Soc., 1938, **60**, 257—262).—A method for the determination of HPO_3'' in presence of $H_2P_2O_5''$, based on the oxidation of HPO_3'' by I, has been developed. The rate of hydration of $H_2P_2O_5''$ in presence of OH′, OAc′, HSO_4', and Cl′, respectively, has been determined with the aid of the above procedure. The rôle of p_H is discussed. E. S. H.

Colorimetric determination of phosphate. I. BERENBLUM and E. CHAIN (Biochem. J., 1938, **32**, 286—294; cf. Taylor and Miller, A., 1914, ii, 675).—MoO_3 is reduced in the absence of PO_4''' by reducing agents commonly used in the determination of PO_4''' [*e.g.*, $SnCl_2$, 1 : 2 : 4-$NH_2{\cdot}C_{10}H_5(OH){\cdot}SO_3H$]. The rate of reduction is greatest when the concn. of acid present is approx. 0·2N, diminishes rapidly to zero as this concn. increases, and is catalytically accelerated by PO_4''' but the acceleration decreases as the acid concn. increases and the reaction remains incomplete because of inactivation of the catalyst by the reaction product. The concn. of MoO_3 and the concn. and nature of the reducing agent affect the rate of reduction, the degree of acceleration

produced by PO_4''' and the end-point attained. The no. of mols. of MoO_3 reduced per atom of P increases with the strength of the reducing agent. W. McC.

Colorimetric determination of phosphate. I. BERENBLUM and E. CHAIN (Biochem. J., 1938, **32**, 295—298).—After removal of protein and neutralisation if necessary, PO_4''' is converted, in presence of H_2SO_4, into phosphomolybdate which is extracted with $Bu^{\beta}OH$ and reduced with $SnCl_2$. The intensity of the blue colour produced is then measured in a colorimeter or with a photo-electric absorbimeter. $0{\cdot}1 \times 10^{-6}$ g. of P can be accurately determined. Changes in concn. of acid or reagents scarcely affect the procedure, which is also almost independent of the action of substances which interfere in other methods. W. McC.

Determination of phosphates in natural waters.—See B., 1938, 325.

Electrical deposition and determination of arsenic. S. TORRANCE (Analyst, 1938, **63**, 104—107).—Quant. electrodeposition of As requires the presence of Cl′, the simultaneous deposition of Cu, and that the As should be in the As^{III} form. Electrolysis is carried out at 50° between Pt gauze electrodes with an auxiliary electrode maintained throughout at 0·4 volt and with the addition of N_2H_4,HCl. As^{V} is reduced to As^{III} with H_2SO_3 before electrolysis. E. C. S.

Determination of small quantities of arsenic in white metals.—See B., 1938, 281.

Determination of carbonic acid in solids. Y. IWASA and K. IWAMOTO (J. Agric. Chem. Soc. Japan, 1938, **14**, 135—139).—By an improvement on Pettenkofer's method very satisfactory results are obtained. J. N. A.

Detection and determination of cyanides in water.—See B., 1938, 325.

Polarographic determination of alkali metals in mineral waters and natural salines. N. V. KOMAR (Zavod. Lab., 1937, **6**, 1074—1078).—The polarographic method gives trustworthy results for determination of the sum of alkali metals in natural H_2O (of the order of 0·001N), after elimination of Ca and Mg. R. T.

Determination of alkalis and strong acids in highly coloured solutions. I. V. OKNIN (Zavod. Lab., 1937, **6**, 1012—1013).—Alkalis are determined by adding NH_4Cl, distilling, and titrating NH_3 in the distillate. Acids are determined similarly, after adding a known excess of standard alkali. R. T.

Determination of potassium by titration with phosphomolybdic acid. M. I. ILMENEV (Zavod. Lab., 1937, **6**, 1018).—The solution is evaporated to dryness, excess of 10% phosphomolybdic acid is added, the ppt. of $K_3PO_4,12MoO_3$ is collected after 16 hr., washed with 3% $NaNO_3$, dissolved in a known vol. of standard KOH, excess of which is titrated, and the K content is hence calc. Na interferes if present in twice the concn. of K. R. T.

Volumetric determination of potassium. I. V. TANANAEV and E. DSHAPARIDZE (Zavod. Lab., 1937, **6**, 1079—1082).—50 ml. of N-NaOH are added to a solution of 1—2 g. of carnallite in hot H_2O, the solution is shaken, diluted to 250 ml., and filtered. An aliquot part of the filtrate is made neutral to Me-orange, excess of 0·25M-$Ca_2Fe(CN)_6$ is added, and the solution is evaporated to dryness. 5 ml. of H_2O and 15 ml. of 5% $CaCl_2,6H_2O$ in 50% EtOH are added, and the ppt. is collected and washed with the same solution. The ppt. is dried, dissolved in dil. H_2SO_4, and the solution is titrated with 0·1N-$KMnO_4$ (1 ml. ≡ 14·9 mg. K). R. T.

Rapid colorimetric determination of potassium with hexanitrodiphenylamine (dipicrylamine); thermodynamic data of the amine and its potassium salt. J. KIELLAND (Ber., 1938, **71**, [*B*], 220—226; cf. Winkel and Maas, A., 1937, I, 45).—The neutral or slightly alkaline solution of the K salt (NH_4 may not be present) is pptd. with a slightly alkaline, about 0·1N solution of the Na salt of hexanitrodiphenylamine (I). The ppt. is centrifuged, the supernatant liquor is removed, and the ppt. is dissolved in H_2O. The extinction of the solution is determined in a Pulfrich photometer against optically pure H_2O; the filter S43 is interposed. Accuracy and reproducibility are very satisfactory. Between 15° and 49° a difference of about 3° causes an error of only 0·1 to 0·3%. The process is particularly applicable to fertilisers. The solubility of (I) and of its K salt (II) in H_2O at various temp. is recorded. The following data for S°_{298}, ΔS°_{298}, ΔF°_{298}, and ΔI°_{298} are recorded: for (I), 105 Clausius, −438 Clausius, +146·5 and +16·01 kg.-cal.; for (II), 118 Clausius, −425 Clausius, +85·4 and −41·3 kg.-cal.; for $[C_6H_2(NO_2)_3]_2N^{\cdot\cdot}$, +89 Clausius, −450 Clausius, +159·9, +25·8 kg.-cal., respectively. H. W.

Quantitative drop analysis. X. Determination of sodium. R. LINDNER and P. L. KIRK (Mikrochem., 1938, **23**, 269—279).—The sample, containing 0·13—4·13 × 10^{-6} g. of Na, is evaporated almost to dryness and treated with Zn uranyl acetate, the ppt. being collected on a glass filter covered with asbestos, washed, and redissolved in 5% H_2SO_4. It is then reduced with metallic Cd and the U titrated with standard $Ce(SO_4)_2$. The method is applicable to the determination of Na in biological materials. J. W. S.

Direct acidimetric micro-titration method for calcium. A. E. SOBEL and S. SKLERSKY (J. Biol. Chem., 1938, **122**, 665—671).—The Ca is pptd. as CaC_2O_4, which is converted into $CaCO_3$ at 475—525°. This is dissolved in hot 10% aq. H_3BO_3, and the solution is diluted and titrated with 0·01N-HCl or -H_2SO_4, using a mixed Me-orange and methylene-blue indicator, to the p_H of pure H_3BO_3 of the same concn. The method is directly applicable to blood-serum. J. W. S.

Volumetric determination of calcium and magnesium. O. PROČKE and J. MICHAL (Coll. Czech. Chem. Comm., 1938, **10**, 20—31).—The method of Fox (A., 1914, ii, 70) gives results with error usually ≯0·2% when addition of reagents in excess is avoided. F. R. G.

Adsorption of diazo-compounds on cadmium and magnesium hydroxides. I. Preparation

of two new spot reagents for cadmium. II. Use of "cadion 2B" for the spot detection of cadmium. F. P. DWYER (J. Proc. Austral. Chem. Inst., 1938, **5**, 32—36, 37—40).—I. Diazotised 1 : 4-$NH_2{\cdot}C_{10}H_6{\cdot}NO_2$ with p-$NH_2{\cdot}C_6H_4{\cdot}N{:}NPh$ gives *4-nitronaphthalenediazoaminobenzene-4'-azobenzene* (*cadion 2B*) (I), m.p. 175° (decomp.), by sudden immersion, 135°. Diazotised 4 : 4'-$NH_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_4{\cdot}NO_2$ with NH_2Ph yields *benzenediazoaminobenzene-4-azo-4'-nitrobenzene* (*cadion 3B*) (II), m.p. by sudden immersion, 191° (decomp.). (I) and (II) in KOH–EtOH (cf. A., 1937, I, 262) give, with solutions containing 1 mg. of Cd per ml., brilliant scarlet and red-violet ppts., respectively, but with 5—10 mg. per ml., sky-blue and bluish-purple ppts., respectively.

II. Using (I), Cd may be detected in presence of 5000 parts of Zn, Cu, Pb, Bi, As, Sb, Al, Cr, Ba, Sr, Mg, Na, K, NH_4, Be, Th, Ce, Nd, Pr, V, Co, Ni, Mn. Hg must be removed. It is possible to detect Cd in 10^5 parts of Zn and 5×10^4 parts of Pb. F. R. G.

Determination of lead in drinking water.—See B., 1938, 325.

Determination of mercury in presence of other metals by means of diphenylcarbazone. R. I. ALEXEEV (Zavod. Lab., 1937, **6**, 955—959).—4 ml. of 0·5N-$Na_4P_2O_7$ are shaken with 2 ml. of solution, and a drop of phenol-red is added. The p_H is adjusted to 7 by means of 0·2N-HNO_3, the vol. is made up to 10 ml., 0·2 ml. of 0·1% diphenylcarbazone is added, and the coloration is compared with that given by standard Hg^{II} solution. The method serves for determination of 1—100 μg. of Hg. It cannot be applied in presence of Sb^{III}, As^{III}, or Sn^{II}, or of $>As^{V}$ 60, Al or Fe^{III} 5, Mg 4, Mn^{II} or Pb 2, Zn or Cd 1, Co or Sn^{IV} 0·5, Mo^{VI} 0·1, Cr^{VI} 0·05, Cu^{II} 0·02, Ag or Au 0·01, or Ni 0·001 mg. R. T.

Determination of mercury by means of formic acid. L. SPITZER (Annali Chim. Appl., 1937, **27**, 566—567).—Hg^{II} salts (in presence or absence of other metals, *e.g.*, Cu) are reduced to Hg by boiling with aq. HCO_2H and the Hg is determined iodometrically. F. O. H.

Importance of hydrogen-ion concentration for the determination and separation of metals by the 8-hydroxyquinoline method. H. GOTÔ (Sci. Rep. Tôhoku, 1937, **26**, 391—413).—The p_H ranges over which 8-hydroxyquinoline causes effective pptn. of $Al^{'''}$, $Zn^{''}$, $Cd^{''}$, $Ni^{''}$, $Mn^{''}$, $Co^{''}$, $Ti^{''''}$, $UO_2^{''}$, $Th^{'''}$, $Pb^{''}$, $Ca^{''}$, $Mg^{''}$, $Fe^{'''}$, $Cu^{''}$, and $Bi^{'''}$ have been determined. By carrying out the reaction at suitable p_H, separation of some of these ions can be effected with this reagent. J. W. S.

Quantitative spectral analysis of solutions. A. K. RUSANOV and S. I. KUNINA (Zavod. Lab., 1937, **6**, 836—840).—In is determined in solutions containing 0·008—0·16% In, by an emission spectrum extinction method. R. T.

Colorimetric determination of manganese with formaldoxime. V. M. PESCHKOVA and A. A. OVSIANNIKOVA (Zavod. Lab., 1937, **6**, 800—803).—1—10 μg. of Mn can be determined colorimetrically by Denigès' method (A., 1932, 491). The presence of equal amounts of Fe, Ni, Co, and Cr does not interfere, but if the concn. of these metals is > that of Mn they should be removed by methods given. Alkali and alkaline-earth metals, and Cl', SO_4'', CO_3'', NO_3', or PO_4''' do not interfere. R. T.

Separation of manganese from magnesium by means of 8-hydroxyquinoline. S. L. TZINBERG (Zavod. Lab., 1937, **6**, 1007—1008).—Mn, but not Mg, is pptd. by 8-hydroxyquinoline in dil. AcOH solution. R. T.

Preservation of a standard solution of potassium permanganate. T. KATÔ (Sci. Rep. Tôhoku, 1937, **26**, 297—302).—After a solution of commercial $KMnO_4$ in ordinary distilled H_2O has been boiled, kept for one day, and passed through an asbestos or glass filter, its concn. remains unchanged for a year without the addition of preservative, if it is stored in a steamed-out bottle covered with black paper. A trace of pptd. MnO_2 or the presence of sunlight hastens decomp. Neutral or alkaline solutions are more stable than acid solutions. J. W. S.

Determination of small amounts of iron. V. G. MOISEEV (Zavod. Lab., 1937, **6**, 912).—Fe is determined in $CaCO_3$ by a minor modification of Egorov's method (*ibid.*, 1935, **4**, 885). R. T.

Colorimetric determination of iron, and its application to analysis of sand and limestone. A. B. SCHACHKELDIAN and M. SCHKITOV (Zavod. Lab., 1937, **6**, 1083—1085).—In the micro-determination of Fe, the intensity of the coloration given with KCNS falls practically to zero as the [$NaPO_3$] rises to 1 mg.-%. The coloration falls to a min. as the [F'] rises from 0·3 to 5·3 mg.-%, above which it rises rapidly. $MgSO_4$, $MnSO_4$, and Na_2HPO_4 slightly depress, and $Cr_2(SO_4)_3$ slightly intensifies, the coloration, in concns. >0·56 mg.-%. $MgCl_2$, $MnCl_2$, NaCl, $CaCl_2$, $AlCl_3$, Li_2CO_3, and $NaTiO_3$ have no effect at any concn. studied. Addition of the interfering substances to the standard is recommended in the determination of Fe in sand and limestone. R. T.

Rapid determination of iron in aluminium alloys.—See B., 1938, 282.

Complex acridine compounds in micro-analysis. A. LANGER (Chem. Listy, 1938, **32**, 66—69).—Of the compounds described by Martini (A., 1930, 882) only those with Co and Ni have the composition assigned to them by Martini; that with Cu is $CuCNS,C_{13}H_9N,HCNS$, and with Fe^{II} is $Fe(CNS)_2,3C_{13}H_9N,3HCNS$. The compound given by Ni with *o*-toluidine is $Ni(CNS)_2,2NH_3,(o\text{-}C_6H_4Me{\cdot}NH_2)_2,2H_2O$. R. T.

Determination of cobalt with 8-hydroxyquinoline. S. L. TZINBERG (Zavod. Lab., 1937, **6**, 1009).—Berg's method (A., 1929, 286) gives trustworthy results. R. T.

Determination of traces [of metallic elements]. E. REICHEL (Berg- u. Hüttenmänn. Jahrb., 1937, **85**, 234—238).—The principles underlying the detection and determination of metals, *e.g.*, Ni, and the use of org. reagents, are discussed. R. B. C.

Behaviour of chromium acetate in qualitative analysis. C. B. DEWITT and G. BALDWIN (J. Chem.

Educ., 1937, **14**, 541—542).—In presence of OAc′ and the absence of other tervalent metals, Cr is not pptd. as the hydroxide on addition of aq. NH_3. The behaviour of solutions containing different proportions of Cr, SO_4, AcOH, and NH_3, and the effect of the addition of Fe, are recorded. The interference by OAc′ is easily overcome by evaporation to dryness in presence of HCl. L. S. T.

Application of salts of complex cations to the microscopic detection of anions. III. 1 : 2-Dinitrotetramminocobaltic nitrate (flavocobaltic nitrate). W. A. HYNES and L. K. YANOWSKI (Mikrochem., 1938, **23**, 280—282).—This reagent yields cryst. products with CrO_4'', Cr_2O_7'', S_2O_6'', and silicotungstate ions which are sufficiently characteristic for the detection of these anions. Characteristic ppts. are also obtained with HSO_4', HSO_3', CO_3'', SiF_6'', S_2O_8'', SeO_4'', and sulphosalicylates. J. W. S.

Solid reducing agents. A. K. BABKO (Zavod. Lab., 1937, **6**, 950—955).—Reduction of Sn^{IV} to Sn^{II}, and of Cu^{II} to Cu^{I}, are readily effected by electrolytic Sb in a Jones reductor, Sn^{II} and Cu^{I} being electrotitrated in the reduced solutions. Electrolytic Zn or Cd reduces Fe^{III} to Fe^{II}, and Ti^{IV} to Ti^{III}, whilst Sb effects only the former reaction; Ti and Fe present together are thus determined. R. T.

Precipitation of metal sulphides by hydrogen sulphide. P. H. PRAUSNITZ (Angew. Chem., 1938, **51**, 77—79).—The H_2S is drawn up through a fritted glass filter crucible and is dispersed throughout the descending salt solution of the metal to be pptd. When pptn. is complete, the direction of suction is reversed, and the ppt. filtered on the crucible. Examples given include the pptn. and determination of Sb as Sb_2S_3, the quant. pptn. of CuS, the quant. pptn. and separation of Sb_2S_3 + CuS, and the simultaneous pptn. of As_2S_3 and CdS. L. S. T.

Organic reagent for bismuth [and antimony]. B. NAIMAN (J. Chem. Educ., 1937, **14**, 484—486).—M-Aq. KI is added to a 3M-HNO_3 solution containing Bi''', followed by a 1% EtOH solution of 1-methylbenzthiazole. A reddish-orange colour or ppt. (needles) is formed. Sb gives yellow needles, but the colour of the Bi ppt. can be discerned in presence of a large excess of Sb. With $Ag^{\cdot}$, $Pb^{\cdot\cdot}$, and $Hg^{\cdot}$ sufficient KI must be added to form BiI_4', and with $Hg^{\cdot\cdot}$, sufficient to dissolve the pptd. HgI_2. Free I liberated by $Cu^{\cdot\cdot}$ or $Fe^{\cdot\cdot\cdot}$ must be removed by $NaHSO_3$. The remaining commoner ions of groups II, III, IV, and V do not interfere. Large amounts of I′, CN′, HSO_3', and S_2O_3'', and HNO_3 and HCl more conc. than 3N, and conc. aq. NH_3 inhibit the test. The purified cryst. Bi ppt. has the composition $C_7H_4NSMe,KBiI_4$. The test can be used as a drop reaction. L. S. T.

Detection of small amounts of niobium and tantalum by means of phenylarsinic acid. I. P. ALIMARIN and B. I. FRID (Zavod. Lab., 1937, **6**, 823—825).—The powdered mineral is fused with 10 parts of $K_2S_2O_8$, and the melt is dissolved in 20% aq. tartaric acid. The solution is saturated with H_2S, excess of which is eliminated from the filtrate. HCl is then added to 2—3N, followed by excess of saturated aq. phenylarsinic acid, when a white ppt. or turbidity is obtained in presence of Nb or Ta (≮2 μg. of Nb_2O_5 or Ta_2O_5 per ml. of solution). Ti and Zr interfere if present in considerable excess; other elements, except F, do not interfere. R. T.

Home-made electric furnace. E. BERTOLET and J. I. OSER (J. Chem. Educ., 1937, **14**, 492—494).—The construction and operation of a small arc furnace which will melt 120 g. of thick Cu wire clippings in 15 min. after reaching its max. temp. (45 min.) is described. L. S. T.

Induction heaters for calorimetry below 1° K. Electrical resistance of gold–silver alloys at low temperatures. W. F. GIAUQUE and J. W. STOUT (J. Amer. Chem. Soc., 1938, **60**, 388—393).—Materials for and design of induction heaters are discussed. Resistance data for six Au–Ag alloys and one Cu–Ag alloy from 2° to 298° K. are recorded. Au–Ag alloys of medium composition are suitable for low-temp. induction heaters as their resistance changes little in the range 1·6—12° K. Formulæ for the heat developed by spherical, cylindrical, and ring types of heaters are given. The resistance of Au containing 0·1% of Ag has a min. at 8° K. Au–Ag alloy induction heaters could be used in presence of large magnetic fields without appreciable correction. E. S. H.

Surfaces of vacuum thermo-elements. F. KERKHOF (Ann. Physik, 1938, [v], **31**, 315—336).—Measurements have been made of the change in sensitivity of a Pt vac. thermo-element when covered with a series of films. A selective increase of sensitivity in the ultra-violet in comparison with a surface blackened with camphor soot was obtained by the use of smooth surfaces of Ag and Au, and a smaller increase uniform from 2900 to 6800 A. was observed for thin grey surface layers such as Bi white, Zn, and Au and Ag amalgams. The influence of film thickness was investigated. Measurements of the absorption of the films were made. O. D. S.

Survey of infra-red spectroscopy. I. Early history and the methods of infra-red spectroscopy. R. B. BARNES and L. G. BONNER (J. Chem. Educ., 1937, **14**, 564—571). L. S. T.

Infra-red photography. Methods and applications. P. MOLLET (Bull. Soc. chim. Belg., 1937, **46**, 525—548).—A review, with detailed reference to "evaporography" (Czerny and Mollet, A., 1938, I, 159). A triple septum comprising absorbing layer (smoke, Bi black), celluloid membrane (0·n μ.), and renewable uniform sensitive layer (paraffin oil, 0·n μ.) is suitably prepared and maintained in a chamber near the v.p. of the liquid (~ 0·01 mm.). The heating effect of an incident beam, passed through the substance to be examined, is transmitted from the absorbing to the sensitive coating causing variable thickness by evaporation at the unabsorbed λλ. A simple optical system transmits interference at the surfaces of the celluloid and liquid coating as a line spectrum for visual or photographic recording. Exposures take a few sec.; the septum is desensitised by lowering the vac. The new technique is compared with current methods, and performance in the range attained

(visual—10 μ.) is shown in absorption spectra of C_6H_6, PhMe, *o*-xylene, and furfuraldehyde (band), and of gaseous HCl (fine structure). I. McA.

Excitation in sources for spectroscopic analysis. G. O. Langstroth and D. R. McRae (Canad. J. Res., 1938, **16**, A, 17—27).—Intensity measurements on the vibration bands of the violet C_2N_2 system and on certain lines in the Sn spectrum indicate that in the condensed d.c. and a.c. spark discharges excitation is predominantly thermal in character, as in the freely-burning C arc. Max. temp. in the discharge columns are approx. 9500, 7800, and 7000° K., respectively, for the d.c. spark, the a.c. spark, and the d.c. arc. The Boltzmann character of the distribution over various energy states disappears when the usual inductance is removed from the d.c. spark circuit. The $3P_2^2$ Sn level shows an abnormal behaviour due possibly to collisions of the second kind. There is evidence that the emitting column in these discharges is surrounded by a relatively cold layer of atoms originating in the material placed on the electrode. L. S. T.

Device for producing flame spectra. A. R. Clark (J. Chem. Educ., 1938, **15**, 39). L. S. T.

Diffraction gratings ruled in metallic films. R. C. Williams (Nature, 1938, **141**, 329—330).—Diffraction gratings are ruled not on Al-coated mirrors but on mirrors coated with a film of Al deposited on one of Cr (cf. A., 1937, I, 634). L. S. T.

Rapid and accurate measurement of line positions on *X*-ray diffraction films with the aid of a cathode-ray oscillograph. H. Tatel and R. Hultgren (Rev. Sci. Instr., 1938, [ii], **9**, 47—50).—In the apparatus described a small portion of the film is scanned by a moving slit, the trace of film transmission versus distance appearing on the screen of a cathode-ray oscillograph. By centring their traces on the screen, the lines are rapidly measured; ordinary back-reflexion *X*-ray lines can be measured to < 0·02 mm. D. F. R.

Precision determination of the linear and angular lattice constants of single crystals. M. J. Buerger (Z. Krist., 1937, **97**, 433—468).—Precision *X*-ray technique and corrections are reviewed and, in systems of low symmetry, the need for single-crystal methods is stressed. Design, scope, and performance of a new instrument yielding symmetric back-reflexion Weissenberg photograms are described and illustrated. Using alloy or adjustable multi-metal anodes for accurate extrapolation to $\theta = \pi/2$, interplanar spacings, and interfacial angles by triangulation, are measurable to at least 5 significant figures. Detailed procedure, a chart, and tables are given. I. McA.

Replacement of vacuum piceine packing in Hadding *X*-ray tubes. A. E. Voitzechovski (Zavod. Lab., 1937, **6**, 1144).—Replacement of cathodes is facilitated by substituting rubber rings for the piceine packing. R. T.

Lead intensifying screens for *X*-ray work. S. T. Nazarov (Zavod. Lab., 1937, **6**, 1134).—A Pb screen 0·1 mm. thick is interposed between the plate and the object under *X*-ray examination. R. T.

Photo-electric transmission spectrophotometer for the measurement of photosensitive solutions. S. Shlaer (J. Opt. Soc. Amer., 1938, **28**, 18—22).—The instrument described was designed to measure in the visible region the absorption spectrum of visual purple, the photosensitive substance of the retinal rods. It is independent of cell and amplifier characteristics and relies only on the law of crossed polarising prisms. The sensitivity is such that the measuring light produces no detectable effect on the measured solution; 1% transmission can be measured to a precision of 1%. N. M. B.

Photographic recording of electrical radiation images in a wave-proof space. H. E. Hollmann (Naturwiss., 1938, **26**, 95).—A method of photographing the paths of electric waves is described. A. J. M.

Direct photography of ultracentrifuge sedimentation curves. J. St. L. Philpot (Nature, 1938, **141**, 283—284).—A photographic method, whereby sedimentation diagrams giving the shape of the curve relating concn. gradient to distance from the axis of rotation are obtained, is described. Photographs of the sedimentation of lysozyme taken by this method are reproduced. L. S. T.

Quantitative fluorescence measurements. F. Bandow (Biochem. Z., 1938, **295**, 154—170).—A review. W. McC.

Photo-electric nephelometer. V. P. Vendt (J. Gen. Chem. Russ., 1937, **7**, 2423—2427).—Apparatus is described. R. T.

Micro-analysis of water. III. Portable colorimeter. T. Tomiyama and M. Watanabe (J. Agric. Chem. Soc. Japan, 1938, **14**, 187—197).—Only a 40-c.c. sample is needed. Two sets of colorimeter tubes eliminate inherent colour or turbidity of H_2O, colour comparison is made by one sight, p_H is determined by Gillespie's method, and distilled H_2O need not be used. J. N. A.

Determination of p_H by a [new type of] calomel electrode. A. Salminen (Suomen Kem., 1938, **11**, A, 9—10).—Apparatus is described. M. H. M. A.

Simple glass electrode potentiometric apparatus. V. A. Zacharevski (Zavod. Lab., 1937, **6**, 962—965).—Apparatus is described. R. T.

Micro-glass electrode.—See B., 1938, 259.

Use of radio waves for measuring dielectric constants of non-conducting liquids. D. Dobor-zyński (Hochfrequenztech., 1936, **47**, 91; Chem. Zentr., 1936, i, 4878).—Previous data (A., 1936, 1481) are supplemented. J. S. A.

Distribution of electrons in focus of *X*-ray tubes. J. Dosse (Z. tech. Physik, 1936, **17**, 121—125; Chem. Zentr., 1936, i, 4952).—A procedure for direct measurement is described. J. S. A.

Grid-controlled ionisation gauge. C. G. Montgomery and D. D. Montgomery (Rev. Sci. Instr., 1938, [ii], **9**, 58).—By using two grids and accelerating only the electrons which have passed the first, the electron current may be made independent of the emission of the filament. D. F. R.

Short-ion path high-voltage tube. W. E. STEPHENS and C. C. LAURITSEN (Rev. Sci. Instr., 1938, [ii], **9**, 51—53).—The vac. tube described, in which the total acceleration of ions takes place in a distance of 18 in., has been used at 10^6 v. peak a.c. with target currents of 5 ma. of electrons and 0·2 ma. of positive ions. D. F. R.

Electron-multiplier as an electron-counting device. Z. BAY (Nature, 1938, **141**, 284).—An electron-multiplier tube with Cs electrodes can be used as an electron-counting device when thermal emission of the Cs surface is eliminated by cooling in liquid air, and when the leakage current is eliminated by suitable spacing of the lead-in wires and insulation of the whole apparatus in dry N_2. Low-speed electrons generated in a vac. by vac. processes only can be counted by the method described. L. S. T.

Electron microscope for studying thermal and secondary electron emission. E. MESCHTER (Rev. Sci. Instr., 1938, [ii], **9**, 12—15).—An electron microscope with magnetic focussing is described, and photographs of a cathode are compared with those obtained by optical methods. R. S. B.

Measurement of ionic beams with the bolometer. E. LEIMBERGER (Physikal. Z., 1938, **39**, 150—155).—The suitability of the vac. bolometer for determining the energy of slow corpuscular rays has been demonstrated, using beams of Li^+. The energy absorbed by the bolometer $\propto$ the no. of ions falling on it in unit time. If the accelerating potential is raised while the no. of ions falling on the bolometer is maintained const. the bolometer indicates a variation of the energy of the beam $\propto$ accelerating potential up to about 1200 v. A. J. M.

Direct determination of the mass of gaseous substances under standard conditions. A. CHRÉTIEN (Compt. rend., 1937, **205**, 1403—1405).—The gas is condensed in a trap immersed in liquid O_2, and suspended from the beam of a balance. The increase of wt. is corr. for the change in buoyancy due to evaporation of O_2. Accuracy to 0·2%, or better, is claimed. A. J. E. W.

Calibration of volumetric vessels by the "volumetric" method. I. L. LOMAKIN (Zavod. Lab., 1937, **6**, 1149—1151).—Methods of calibration of pipettes, burettes, and measuring flasks are described. R. T.

Micro-burette with refilling device and operated with air pressure. J. MIKA (Mikrochem., 1938, **23**, 304—307).—The micro-burette described is fitted near its upper end with a side tube carrying a reservoir, enabling the liquid in the burette to be replenished by tilting. The jet of the burette is very narrow (0·1—0·2 mm.) and liquid flow is controlled by hand-bellows. J. W. S.

Automatic measurement of density of liquids. A. I. LIBERMAN (Zavod. Lab., 1937, **6**, 1022—1024).—Apparatus is described. R. T.

Rule for calculating titration results. J. S. LIALIKOV (Zavod. Lab., 1937, **6**, 1024—1025).—A slide-rule is described. R. T.

Improved laboratory table. V. G. TIMOSCHEV (Zavod. Lab., 1937, **6**, 1147—1149).—A standard laboratory bench, composed of units, is described. R. T.

Determination of volatile acids. A. G. KULMAN (Zavod. Lab., 1937, **6**, 1145—1147).—Apparatus for steam-distillation is described. R. T.

Graphical illustration of three-component systems having solid solutions. A. P. BELOPOLSKI (Kalii, 1937, **6**, Nos. 5—6, 33—39).—Right-angle diagrams are used to illustrate hypothetical cases of three-component systems containing solid solutions. The construction and interpretation of the diagrams are discussed theoretically. D. G.

Surface tension by maximum bubble pressure. H. M. HAENDLER, and W. S. MCGUIRE (J. Chem. Educ., 1937, **14**, 591—592).—Apparatus and method are described. L. S. T.

Separation of mixtures by centrifuging. J. W. BEAMS and L. B. SNODDY (J. Chem. Physics, 1937, **5**, 993—994).—A vac. tubular centrifuge, described briefly, has been used to separate the constituents of a const.-boiling mixture of CCl_4 and MeOH in the vapour state. W. R. A.

Determination of sedimentation rate and equilibrium in centrifuges and opaque ultra-centrifuges. J. W. MCBAIN (Science, 1938, **87**, 93—94).—A summary of various methods. L. S. T.

Automatic hydrogen sulphide generator. G. ATCHISON and D. O. HOLLAND (J. Chem. Educ., 1937, **14**, 581—582).—H_2S is generated by electrically heating a Pyrex tube containing one of the solid commercial products, and collected in a storage bottle where it is kept at a relatively const. pressure by means of an automatic switch, which operates the heater coil circuit. L. S. T.

Mechanical shaking device. L. F. BORCHARDT, F. C. HILDEBRAND, and B. A. MCCLELLAN (Cereal Chem., 1938, **15**, 116—118).—Different sized flasks, held in place by a screw on to the stopper, are placed on a rubber-covered plate, agitated continuously or intermittently by an eccentric. E. A. F.

Micro-mol. wt. determinations by m.p. depression, and some theoretical considerations. J. PIRSCH (Angew. Chem., 1938, **51**, 73—77).—Mol. latent heat bears a linear relationship to abs. m.p. for compounds of similar structure. For substances having spherical or three-dimensional mols., the relation is linear only over a small range of temp., and the mol. heat is relatively very small. Such substances (*e.g.*, derivatives of camphane and α-di*cyclo*pentadiene) have very high mol. depression consts., and can be used for mol. wt. determinations when camphor is unsuitable, the solvent selected being chemically similar to the compound to be determined, and of appropriate m.p. Methods for the determination of solids, oils, and volatile liquids are described, and cryoscopic data of suitable solvents are given. A. LT.

Differential hot-wire gaseous flow meter M. J. E. GOLAY (Rev. Sci. Instr., 1938, [ii], **9**, 55—57).—By causing the gaseous flow to effect a transfer of

heat from two adjacent heated grids, a flow meter with a linear response, and with indications reversing when the direction of flow is reversed, is obtained. D. F. R.

Automatic analysis for elements. H. REIHLEN (Mikrochem., 1938, **23**, 285—301; cf. A., 1934, 385).—A micro-form of the apparatus for org. combustions is described. CuO containing Cu, Pb, Cr, Mn, and Ag in the at. ratio 12 : 3 : 3 : 1 : 1 is recommended as oxidation catalyst. J. W. S.

Regulator for weak currents of gas. J. W. HIBY (Physikal. Z., 1938, **39**, 167).—The flow of gas is controlled by inserting a wire to different distances into a capillary tube through which the gas passes. The apparatus is suitable for controlling the flow of gas in filling discharge tubes, and can be calibrated. A. J. M.

Porous filter plates in membrane filters. F. SARTORIUS (Österr. Chem. Ztg., 1938, **41**, 101—102). —Coarse stone and fine glass filter plates give the greatest throughput in membrane filters. R. S. C.

Preparation of filters with a thick layer of filtering material. T. M. GRINSCHTEIN (Zavod. Lab., 1937, **6**, 892).—A paraffined pasteboard cylinder is fitted into a Buchner funnel. R. T.

Utility of Christiansen filters. K. VON FRAGSTEIN (Ann. Physik, 1938, [v], **31**, 443—452).—Improvements are described by which the Christiansen filter is made independent of changes in room temp. and pressure. Fluorite and aq. glycerol can be used in a Christiansen filter for λλ down to 235 mμ. The combination of absorption and Christiansen filters is discussed and a crit. comparison made between the Christiansen filter and the monochromator. O. D. S.

H. le Chatelier, 1850—1936. A. SILVERMANN (J. Chem. Educ., 1937, **14**, 555—560).—Biographical. L. S. T.

Chemical investigation of the ancient metallic culture in the Orient. T. DŌNO (J. Fac. Sci., Tokyo, 1937, Sect. I, **3**, 287—327).—Chemical analyses recorded for numerous spear-heads and halberds unearthed from the Yin site in Honan establish the existence of a Cu age preceding the bronze age in ancient China as in Egypt and other countries. Numerous chemical analyses of weapons of the bronze age and arrow-heads of the Fe age in China have been made and are discussed. Arrow-heads of the Han dynasty from Lo-lang, in Chosen, had cores of wrought-Fe or steel, still showing lustre and no corrosion, or cores of slag, all with bronze coatings. Photographs of etched and polished sections of the above specimens are also reproduced. L. S. T.

Geochemistry.

Radon content of some mineral springs of Japan. S. IIMORI and S. HATA (Bull. Inst. Phys. Chem. Res. Japan, 1937, **16**, 1471—1478).—The Rn content of 13 springs and a well H_2O has been determined, and the dissolution in H_2O of Rn and Ra contained in xenotime has been determined. R. S. B.

Mineral water from the "Lete" spring in Pratella (Campobasso) [Italy]. M. TALENTI (Annali Chim. Appl., 1937, **27**, 560—563).—Data for the chemical, physico-chemical, radioactive, and gaseous characteristics of the H_2O are tabulated. F. O. H.

Isotopic constitution of snow and of the water of mountain rivers. A. I. BRODSKI, O. K. SKARRE, E. I. DONZOVA, and M. M. SLUTZKAJA (J. Phys. Chem. Russ., 1937, **10**, 731—738).—Measurements of d and n of a water specimen allow the calculation of its HDO and $H_2{}^{18}O$ contents. Snow contains 20—30% D < and 1—2% ^{18}O > the ordinary water. Various mountain rivers give different results. The exchange of ^{18}O between air and water on Pt is recorded. J. J. B.

Relation of salinity to the calcium carbonate content of marine sediments. P. D. TRASK (U.S. Geol. Survey, Prof. Paper 186-N, 1936, 273—299).—A discussion of the relation of the $CaCO_3$ content of marine sediments to the salinity of the H_2O, with special reference to the surface layers. A study of the factors influencing deposition of $CaCO_3$, especially the effect of salinity and temp. on the solubility of $CaCO_3$ in sea-H_2O, a statistical study of the relation of salinity, temp., and depth to the $CaCO_3$ content of sediments in many parts of the world, and a map showing the relation of the areal distribution of $CaCO_3$ on the sea floor to the surface salinity, surface temp., and depth of H_2O, all indicate that salinity is definitely related to the $CaCO_3$ content of sediments. Geological applications of the results include a consideration of the deposition of red clay. L. S. T.

Liquid state of the primitive earth. A. MERCIER (Nature, 1938, **141**, 201).—A theory supporting the view that the earth must have been in a liquid state at an epoch near the beginning of its formation, and providing an explanation of the Fe core generally regarded as occupying the centre of the earth, is advanced. L. S. T.

Interatomic distances in marcasite. Bonding in crystals of löllingite, arsenopyrite, and marcasite types. M. J. BUERGER (Z. Krist., 1937, **97**, 504—513; cf. A., 1937, I, 204, 287).—A reply to Huggins (*ibid.*, **96**, 384). New precision technique (A., 1938, I, 215) confirms the author's marcasite structure. The rhombic cell has a 4·436, b 5·414, c 3·381 A.; the co-ordination interat. distances S–Fe (2 at 2·250, 1 at 2·231 A.), S–S (2·210 A.), are distinct from those of pyrite. The inaccuracy of Huggins' rule (A., 1934, 350) applied to FeS_2 extends to marcasite-like types, FeP_2, $FeAs_2$, $(FeSb_2)$; in these, a c-axis compression and the deformed octahedral environment of Fe are ascribed to additional bonds between unpaired P, As, or Sb atoms. Similar S bonding in marcasite, necessarily absent in pyrite, could explain observed differences. I. McA.

Composition and crystallography of autunite and meta-autunites. J. Beintema (Rec. trav. chim., 1938, **57**, 155—175).—The prep. of artificial autunite, $Ca(UO_2)_2(PO_4)_2,nH_2O$ (I), is described. The val. of n varies with temp. and humidity between 10·5 and 8 without affecting the X-ray powder diagram. Under mildly dehydrating conditions (I) changes into meta-autunite-I (II), which gives an X-ray spectrogram distinct from that of (I), and has $n = 6·5—2·5$. Above 80° (II) changes into meta-autunite-II (III), which has $n = 0—6$ and gives a third distinct spectrogram. The transformation (I) →(II) is reversible, and (II)→(III) irreversible. Crystallographic data for the three forms are given. The Ca is reversibly exchangeable with Na or H. F. L. U.

Magnesium silicates of asbestiform types not belonging to the antigorite group. S. Caillère (Bull. Soc. Franç. Min., 1936, **59**, 353—374).—Chemical analyses, dehydration curves, and X-ray investigations of various sepiolites and palygorskites are recorded. L. S. T.

System $NaAlSiO_4$–FeO–SiO_2.—See A., 1938, I, 197.

Stilbite. J. Sekanina and J. Wyart (Bull. Soc. Franç. Min., 1936, **59**, 377—383).—Stilbite from the Faroe islands has a 13·60, b 18·13, c 11·29 A., β 52° 0′ (X-rays), giving $a : b : c$ 0·750 : 1 : 0·623. The probable space-group is $C_{2h}^3 = C_m^2$; d 2·182. Chemical analyses are summarised. The stilbites can be represented by $Na_xCa_{2+y}Al_{4+x+2y}Si_{14-x-2y}O_{36},14H_2O$. The structural skeleton is composed of a group of $(Si,Al)O_4$ tetrahedra of which the summits, occupied by O, are common to two tetrahedra. A close analogy between stilbite and heulandite is pointed out. L. S. T.

Harmotome. J. Sekanina and J. Wyart (Bull. Soc. Franç. Min., 1937, **60**, 139—145).—A Laue diagram of harmotome from Strontian, Argyllshire, gives a 9·80, b 14·10, and c 8·66 A.; $a : b : c = 0·695 : 1 : 0·614$ with β 55° 10′; space-group $C_{2h}^2 = P\frac{2_1}{m}$ or $C_2^2 = P2_1$; d is 2·450. Chemical analyses are summarised and give the formulæ $Ba_2Al_4Si_{12}O_{32},12H_2O$ or $(Na,K)_xBa_2Al_{4+x}Si_{12-x}O_{32},12H_2O$. A close relationship between harmotome and stilbite cannot now be maintained. L. S. T.

Structural environment of the Bendigo goldfield. J. B. Stone (Econ. Geol., 1937, **32**, 867—895).—The mineralogy and structure of the quartz reefs and the genesis of the ore are also discussed. L. S. T.

Sedimentary deposits of copper, vanadium-uranium, and silver in south western United States. R. P. Fischer (Econ. Geol., 1937, **32**, 906—951).—Various widely-spread deposits are described and their genesis is discussed. L. S. T.

Eruptive rocks of Zlatibor, Yugoslavia, and their relations with the crystalline schists and sedimentary environment. S. Pavlovitch (Bull. Soc. Franç. Min., 1937, **60**, 5—137).—A geological, mineralogical, and chemical study of the cherzolites and serpentines, gabbros, and dolerites which constitute the different types of eruptive rocks of the Zlatibor massif. The relationships of the mineral deposits of giobertite ($MgCO_3$) and chromite to these rocks are discussed. The cryst. schists, which consist of orthoamphibolites and para-gneiss, are described. Numerous chemical analyses are recorded. L. S. T.

Characteristics of sepiolite from Ampandandrava, Madagascar. Formula of the sepiolites. H. Longchambon (Bull. Soc. Franç. Min., 1937, **60**, 232—276; cf. A., 1937, I, 432).—X-Ray data are recorded for the natural mineral. Changes in structure on heating to 1200° have been followed by means of diffraction photographs. Dilatometric–temp. and dehydration–temp. curves are recorded and interpreted. The chemical formula of the sepiolites is discussed, and $Si_4O_{11}(MgH_2)_3,H_2O(H_2O)_n$ or $(Si_4O_{11})_3Mg_8H_2,3H_2O(H_2O)_n$ is proposed. L. S. T.

Two new pyroxenes in the system clinoenstatite–clinoferrosilite–diopside–hedenbergite. W. A. Deer and L. R. Wager (Min. Mag., 1938, **25**, 15—22).—Analyses of two monoclinic pyroxenes, separated from the gabbro at Kangerdlugssuak, E. Greenland, show much FeO (25·13 and 31·54%) with low sesquioxides (Al_2O_3 2·25 and 5·24, Fe_2O_3 4·72 and 3·74%). The formulæ deduced are:

$(Mg,Fe^{II},Fe^{III},Ca,Mn,Na)_2[(Si,Al,Ti)_2O_6]$,
$(Mg,Fe^{II},Fe^{III},Ca,Mn,Na,K,TiAl)_2[(Si,Al)_2O_6]$.

These are plotted with some earlier analyses on triangular diagrams ($FeSiO_3$–$MgSiO_3$–$CaSiO_3$) to show the variation of the optical data with chemical composition. L. J. S.

Review of data of Mg–Fe-clinopyroxenes. N. F. M. Henry (Min. Mag., 1938, **25**, 23—29).—The identification of clinoenstatite and clinohypersthene in igneous rocks has often been based on inclined optical extinction (but this may be shown by chance sections of orthorhombic crystals), and reported occurrences are doubtful, except in meteorites and in artificial products (cf. A., 1935, 447; 1936, 49). L. J. S.

Pebbly structure of the phosphatic chalks of the North of France, and their multiple origin. L. Cayeux (Compt. rend., 1938, **206**, 392—394).—Different causes of the pebbly structure are reviewed. A. J. E. W.

Lherzolites in the course of serpentinisation in the Lorraine Vosges. (Mme.) E. Jérémine (Compt. rend., 1938, **206**, 441—443).—Mineralogical and chemical analyses are given. A. J. E. W.

Identification of gems by irradiation with ultra-violet light. O. Holstein (Deuts. Goldschmiede-Ztg., 1936, **39**, 150—151; Chem. Zentr., 1936, i, 4949).—Aquamarine, gold beryl, rose beryl, chrysoberyl, chrysolyte, kunzite, emerald, topaz, and tourmaline may be identified by means of their fluorescence colours. White zircons are discoloured by irradiation. J. S. A.

Production of synthetic gems. E. H. Kraus (Amer. Min., 1937, **22**, 206).—A description of certain phases of manufacturing processes, and the characteristic properties of synthetic ruby, sapphire, spinel, and emerald. L. S. T.

Meteorites of Nassirah, New Caledonia. A. Lacroix (Bull. Soc. Franç. Min., 1937, **60**, 226—229).—Descriptive. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

MAY, 1938.

Continuous spectrum of hydrogen. N. D. SMITH (J. Opt. Soc. Amer., 1938, **28**, 40—45).—Conditions for max. intensity of the continuous spectrum of H_2 have been investigated. The construction of a H_2 tube superior in intensity to the C arc for $\lambda\lambda$ <2924 A. is described. O. D. S.

Measurements on the forbidden *P*–*P* series of the Li I spectrum in the carbon arc. R. SIKSNA (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 253—263).—$\lambda\lambda$ and relative intensities of three *P*–*P* lines are recorded; no appreciable shift of the lines in the arc is observed. Microphotometer traces show the lines to be asymmetric, the asymmetry being greater for the higher members of the series. A. J. E. W.

High-pressure afterglow in nitrogen. J. KAPLAN (Physical Rev., 1936, [ii], **50**, 384—385).—As pressure is increased, the Goldstein-Kaplan bands in the discharge which originate on $v' = 1$ increase in intensity relatively to those originating on $v' = 0$. The enhancement on the $v' = 1$ level appears to be due to the increased no. of collisions between metastable N mols. with increased pressure. This indicates a mechanism from which N afterglows derive their long lives. L. S. T.

Two afterglow phenomena in nitrogen. J. KAPLAN (Physical Rev., 1936, [ii], **50**, 390).—The after-glow phenomena reported indicate that the most probable origin of the auroral spectrum lies in an excitation of "auroral" active N. L. S. T.

(A) Isotope shift in the spectrum of magnesium Mg I. (B) Structure of the 3^3D terms of magnesium Mg I. K. W. MEISSNER (Ann. Physik, 1938, [v], **31**, 505—517, 518—521).—(A) The fine structure of the Mg arc lines from 8800 to 3800 A. has been measured by an interferometric method using as source a Mg at. beam excited by electron collision. $\lambda\lambda$ accurate to $\pm$0·0005 A. are tabulated. In the strongest lines of the I and II normal series of the singlet system three components corresponding with the isotopes Mg 24, 25, 26 are observed. The term isotope shifts of the 3^1P terms and some ^1D terms are calc.

(B) The 3^3D term of Mg I is partly reversed $D_2 > D_3 > D_1$ and the splittings are abnormally small compared with those of the $3P$ terms, D_2–D_3, 0·017 cm.$^{-1}$, D_3–D_1, 0·012 cm.$^{-1}$ Two of the theoretical three satellites have been observed. O. D. S.

Active nitrogen. D. B. MCNEILL (Phil. Mag., 1938, [vii], **25**, 471—475).—NaCl, KCl, or LiCl coated on the inner wall of a discharge tube containing N_2, through which a discharge was passed, became discoloured. The NH band was observed in the spectrum of the discharge. The persistence of the NH band spectrum in a H discharge containing N may be due to formation of the stable ion NH^-. H. J. E.

Hyperfine structure of the aluminium spark line 2669·2 A. R. RITSCHL (Physikal. Z., 1938, **39**, 287—288).—The hyperfine structure of the Al spark line at 2669·2 A. has been reinvestigated. There are three components, the intensity of which decreases in the direction of longer λ. A. J. M.

Influence of ammonium chloride on the emission-spectral lines of a metal during the passage of a spark between a positive electrode and an electrolyte. P. JOLIBOIS (Z. anorg. Chem., 1938, **236**, 121—123).—Addition of NH_4Cl to a solution containing Mn causes a marked increase in the intensity of the line 2798·3 A. F. J. G.

Relative *f*-values for lines of Fe I and Ti I. R. B. KING and A. S. KING (Astrophys. J., 1938, **87**, 24—39).—Vals. for 115 lines in 29 multiplets of Fe I between 2912 and 5455 A. and for 227 lines in 66 multiplets of Ti I between 3123 and 6743 A., derived from measurements on electric furnace absorption spectrograms, are recorded. All the lines arise from the lowest terms in the atoms, ranging in excitation potential from 0 to 1·5 v. for Fe I and from 0 to 2·5 v. for Ti I. L. S. T.

Third spark spectrum of krypton. A. BALANKESWARARAO and S. G. KRISHNAMURTY (Current Sci., 1938, **6**, 329).—The fundamental multiplets $5s^4P$–$5p^4D$ and $5s^4P$–$5p^4P$ in Kr IV were located in the spectrum obtained by passing highly-condensed discharges through Kr gas. The $5s$, $5p$, and a no. of md terms have been evaluated. L. S. T.

Determination of the relative transition probabilities in the spectrum of cadmium. L. S. ORNSTEIN, J. P. A. VAN HENGSTUM, and H. BRINKMAN (Physica, 1938, **5**, 145—152).—Photographic measurements of the relative intensities of the principal Cd lines, produced in a.c. and d.c. arcs, are recorded. Relative vals. of the Einstein transition probabilities are deduced, assuming the arcs to be Boltzmann radiators; good agreement is obtained for different d.c. arcs, and for a.c. arcs in different phases, showing the emission mechanism to be thermal in character. In the m^3D–5^3P multiplets the agreement with the sum rule for intensities is good, but deviations are observed in the m^3S–5^3P triplets. A. J. E. W.

Absorption spectrum of the diatomic antimony molecule (Sb_2). S. M. NAUDÉ (S. African

J. Sci., 1935, **32**, 103—112).—Absorption bands at λλ 2200—2318 A. and at λλ 2842—3315 A. were observed, 115 bands in the latter system being analysed. The isotope effect for ^{121}Sb and ^{123}Sb was observed. CH. ABS. (e)

Spectra of iodine V and iodine VI. S. G. KRISHNAMURTY and R. SANJIVARAO (Current Sci., 1938, **6**, 329).—The spectrum of a highly condensed discharge through I vapour in narrow capillary tubes has a prominent pair of lines apparently due to I V in the region 3200—2400 A. The intervals $5p^2{}^2D_{1\frac{1}{2}}$—$^2D_{2\frac{1}{2}}$ and $5p^2{}^2P_{\frac{1}{2}}$—$^2P_{1\frac{1}{2}}$ are 3073 and 3328 cm.$^{-1}$, respectively. Many terms due to $5p$, $6p$; $5p^2$, $5d$, and $6s$ configurations were identified. The largest term $5p^2P_{\frac{1}{2}}$ gave an ionisation potential of 31·6 V. for I V. Thirteen terms due to I VI were identified. L. S. T.

Spectrum of Ce IV. R. J. LANG (Physical Rev., 1936, [ii], **50**, 397).—20 energy levels, including 2 members of the F series, have been found. L. S. T.

Magnetic moments of $^{151}_{63}$Eu, $^{153}_{63}$Eu, $^{185}_{75}$Re, $^{187}_{75}$Re, $^{79}_{35}$Br, and $^{81}_{35}$Br. T. SCHMIDT (Z. Physik, 1938, **108**, 408—420).—These are calc. from the hyperfine structures of the corresponding spectra. A table is given of all the known nuclear magnetic moments to date. L. G. G.

Sparking potential of mercury vapour. F. L. JONES and W. R. GALLOWAY (Proc. Physical Soc., 1938, **50**, 207—212).—A detailed account of investigations previously reported (cf. A., 1937, I, 54). N. M. B.

Factors influencing the sparking potential in mercury vapour. E. J. LAWTON and K. H. KINGDON (Physical Rev., 1936, [ii], **50**, 1095).—The sparking potential between close Ni electrodes in Hg vapour at 0·002 mm. is reduced 15-fold by a few min. bombardment of one electrode with 2000-v. positive ions. The reduction ∝ time of bombardment and ion voltage. A 4-fold reduction also occurs after an electron current of several amp. has been passed between the electrode and a BaO cathode. Both effects are destroyed by sparking the electrodes several times at high voltages. L. S. T.

Radial inhomogeneity of the radiation emitted in the contracted mercury arc. E FISCHER and H. KÖNIG (Physikal. Z., 1938, **39**, 313—316).—The distribution of light intensity of the lines 2699 and 2537 A. of the Hg arc (1·5 atm.), and of the continuous radiation at 3300 A. and 2804—2904 A., has been examined in connexion with the diameter of the arc. A. J. M.

Hyperfine structure and wave-length of the infra-red Hg I 6^1P–7^1S line. M. H. M. HUNT and J. S. CAMPBELL (Physical Rev., 1936, [ii], **50**, 397).—The hyperfine structure of the Hg arc line 10,140 A. has been photographed with a Fabry–Perot interferometer at mirror separations ranging from 10 to 60 mm. The total magnetic separations of ^{199}Hg and ^{201}Hg in 6^1P_1 are 185 and 171, respectively. The principal components due to ^{200}Hg and ^{202}Hg show a relative shift of 17. 6^1P has a shift of approx. 12 between consecutive even isotope levels. The strongest component of ^{201}Hg is 10,139·881 A., with 10,139·811 A. as the centre of gravity. L. S. T.

Intensity measurements in hyperfine structure of the mercury line 6^3P_2–7^3S_1 (λ = 5461 A.) in absorption. H. C. BURGER and P. H. VAN CITTERT (Physica, 1938, **5**, 177—187).—Wave-no. differences and intensities of the hyperfine structure components have been measured using a Gehrcke and Lau interference spectrograph. Schüler's interpretation of the structure of the central components is slightly modified to account for observed intensities (cf. A., 1931, 993). The centres of gravity of the 199 and 201 isotope lines coincide with those of the 198 and 200 isotope lines, respectively. A. J. E. W.

Measurements of reversal and emission of electrically excited thallium vapour. G. KURZ (Ann. Physik, 1938, [v], **31**, 473—496).—Measurements of omission and reversal of the $7^2S_{1/2} \rightarrow 6^2P_{1/2}$ and $7^2S_{1/2} \rightarrow 6^2P_{3/2}$ Tl lines have been made at pressures from 3×10^{-5} to 3×10^{-3} Torr and current strengths from 12 to 1250 ma. Reversal measurements give vals. of the excitation temp. 2650—3800° K. and a distribution of atoms among the three states discussed: $7^2S_{1/2}$ 1×10^{-4} total atoms, $6^2P_{1/2}$ 50—66%, $6^2P_{3/2}$ 34—50%. This distribution corresponds with excitation temp. about 13,400°. There is no statistical equilibrium. From emission measurements ionisation is shown to take place to about 60% of the Tl atoms. O. D. S.

Solar radiation at 2100 A. V. H. REGENER (Naturwiss., 1938, **26**, 141—142).—Three balloon ascents with special registering apparatus to heights of about 25 km. did not show the existence of solar radiation of λ 2100 A. A. J. M.

Excitation of emission lines in late-type variables. A. D. THACKERAY (Astrophys. J., 1937, **86**, 499—508).—Twelve bright lines in Me variables are attributed to resonance excitation, chiefly by lines in the ultra-violet; *e.g.*, the Mg II line 2795 A. excites the observed emission lines 4202, 4308, and 3852 of Fe, and the Mg II line 2802 A. excites the Ti line 4372 A. Five other lines are attributed to intercombination lines of Fe II. The Mg II lines can be excited by chemiluminescence in the formation of H_2, the most abundant mol. L. S. T.

Stark resolution of hydrogen lines in the spectra of white dwarf stars. J. M. RAMBERG (Naturwiss., 1938, **26**, 140—141).—Investigation of the spectrum of the newly discovered white dwarf star (No. 398 in the "Catalogue of Proper Motion Stars") shows that it is of the spectral type A o. The H_γ, H_δ, and H_ϵ lines are considerably widened and diffuse. Balmer lines of higher term no. have disappeared. The intensity in the ultra-violet is very high. The H lines show a Stark splitting. A. J. M.

First positive group of nitrogen in the spectrum of the Finsler comet (1937, *f*). J. GAUZIT (Compt. rend., 1938, **206**, 492—494; cf. A., 1938, I, 166).—The observed band-heads are recorded, and the excitation of the group by absorption of solar radiation is discussed. A. J. E. W.

Spectroscopic and spectrophotometric observations of the comet Finsler (1937, *f*). A. Colacevich (Atti R. Accad. Lincei, 1937, [vi], **26**, 227—232). O. J. W.

Unidentified interstellar lines in the yellow and red. P. W. Merrill and O. C. Wilson (Astrophys. J., 1938, **87**, 9—23).—Six lines in the region 5780—6614 A. are discussed. Their widths make an at. origin improbable. L. S. T.

Fundamental arc series in sodium and its presence in the sun. P. Rood and R. A. Sawyer (Astrophys. J., 1938, **87**, 68—71).—The infra-red arc spectrum of Na has been photographed and measured with a thermopile as far as 12,679 A. (3^2D—5^2F^0). Five new members of the $^2D^2F^0$ series in Na I have been measured. This series is probably present in the sun. New vals. for the $^2F^0$ terms are given, and three members of the 4^2S—5^2P^0 series have been observed for the first time. L. S. T.

Temperature in the solar reversing layer derived from titanium lines. R. B. King (Astrophys. J., 1938, **87**, 40—44).—A comparison of the equiv. widths of solar Ti I lines with laboratory *gf*-vals. gives a mean temp. of 4400° K. L. S. T.

Spectrum of the aurora of 25 January, 1938. J. Dufay and J. Gauzit (Compt. rend., 1938, **206**, 619—621).—The aurora showed the presence of bands due to the first positive system of N_2, and of two red lines of considerable intensity compared with that of the green line. Lines 6523, 6450, 6390, 6128, and 5840 A. (?) were observed. R. S. B.

Effect of chemical combination on the $K\alpha_{1,2}$ line of sodium. N. G. Johnson (Physical Rev., 1938, [ii], **53**, 434—435).—Using a tube for secondary fluorescence *X*-rays connected with a high-vac. spectrograph, a minute displacement to shorter λλ has been detected for the $K\alpha_{1,2}$ line which appears as an unresolved doublet. Displacement measurements for 14 compounds of Na are tabulated. N. M. B.

$L\alpha$ and $L\beta$ lines of elements $_{32}$Ge to $_{26}$Fe and their compounds and alloys. E. Gwinner (Z. Physik, 1938, **108**, 523—540).—Variations in intensity and shape of the $L\alpha$ and $L\beta$ lines and their satellites for these elements in their various chemical compounds and alloys were examined with a high-vac. spectrometer. A no. of new satellites were found and measured. With Ge, Ga, and Zn, $L\alpha$ and $L\beta$ are completely symmetrical; with Fe, Co, and Ni, these lines are much steeper on the short-wave side. The general contour of the lines and their half width are closely related to chemical union. The intensity ratio, $L\alpha$ to $L\beta$, is the same in both Fe and Fe_2O_3. Line symmetry is discussed in relation to the electronic theory of solid bodies. H. C. G.

***L* emission and absorption spectra of thorium, and its characteristic levels.** (Mlles.) Y. Cauchois and M. L. Allais (Compt. rend., 1938, **206**, 344—346).—λλ of 23 emission lines in the L_{I}, L_{II}, and L_{III} systems, and of six absorption lines and discontinuities, are recorded, and the frequencies of the principal electronic levels are given. A. J. E. W.

Multiple ionisation of inner electron shells. F. K. Richtmeyer (Rev. Mod. Physics, 1937, **9**, 391—402).—A survey of measurements of the satellites and the breadth of *X*-ray lines, and their interpretation on the basis of multiple ionisation by electron collision and by the Auger effect. O. D. S.

Probe theory in gases at high pressures. F. Borgnis (Ann. Physik, 1938, [v], **31**, 497—504).—The relation, for a plane probe in a gas, between the probe potential, probe current, and the thickness of the Langmuir layer covering the probe is investigated for pressures such that collisions occur between ions and gas mols. within the Langmuir layer, and a formula is deduced. O. D. S.

Effect of a magnetic field on the photo-electric properties of iron. D. H. Loughridge and N. K. Olsen (Physical Rev., 1936, [ii], **50**, 389).—Measurements near 2200 A. with a magnetic field of approx. 5000 gauss in a saturated electric field >200 v. showed no change in the emission of an Fe cylinder, coated with electrolytically deposited Fe, when the magnetic field was applied. The long-λ limit is approx. 2500 A. L. S. T.

Contribution of the photo-electric effect to the sparking mechanism in the noble gases at high pressures. A. A. Kruithof and F. M. Penning (Physica, 1938, **5**, 203—204).—Theoretical. A. J. E. W.

Photo-electric ionisation in the ionosphere. E. O. Hulburt (Physical Rev., 1938, [ii], **53**, 344—351).—Mathematical. The ionisation equilibrium in the various atm. gases is calc. from the Saha theory. Results are discussed and compared with experimental data. N. M. B.

New type of electret: photo-electrets. G. Nadjakov (Physikal. Z., 1938, **39**, 226—227).—A new type of permanent polarisation of some dielectrics occasioned by the simultaneous action of light and an electric field is considered. The polarisation is shown only by dielectrics which have a characteristic photo-conductivity (*e.g.*, S). The state is described as a photo-permanent-polarised state, and the dielectric under this condition is referred to as a photo-electret. A. J. M.

Influence of crystal structure on electron emission from " 218 " tungsten wire. W. B. Nottingham (Physical Rev., 1936, [ii], **50**, 398—399).—A discussion (cf. A., 1936, 553). L. S. T.

Electron and limits to the precision of electromagnetic field specifications. W. H. Watson (Trans. Roy. Soc. Canada, 1937, [iii], **31**, III, 47—55).—Mathematical. The uncertainty relations for an electromagnetic field are applied to determine the corresponding uncertainties in the motion of an electron in the field. N. M. B.

Diffusion of electrons in a magnetic field. J. S. Townsend (Phil. Mag., 1938, [vii], **25**, 459—470). H. J. E.

Production of pairs and Compton electrons by γ-radiation from the bombardment of lithium by protons. L. A. Delsasso, W. A. Fowler, and C. C. Lauritsen (Physical Rev., 1936, [ii], **50**, 389).—

Stereoscopic cloud chamber photographs have been taken of pairs and Compton electrons ejected from thin sheets of C and Pb by the γ-radiation from Li bombarded by protons. Most of the radiation is conc. in a band or line at approx. 17 m.e.v. L. S. T.

"Phase focussing" of electron motion in rapidly changing electric fields. E. BRÜCHE and A. RECKNAGEL (Z. Physik, 1938, **108**, 459—482).—Theoretical. The laws governing the focussing effects observed when beams of electrons pass through rapidly changing electric fields are examined and compared with those of ordinary optics. H. C. G.

Scattering and dissociation of slow ions. F. WOLF (Ann. Physik, 1938, [v], **31**, 561—568; cf. A., 1937, I, 542).—Effective cross-sections for the processes $H_2^+ \rightarrow N_2$ and $N_2^+ \rightarrow H_2$, He, Ne, and A have been measured. From the difference between effective and charge-transfer cross-sections for a no. of collision processes of H_2^+ and N_2^+, and empirical vals. of the scattering in these processes, it is deduced that the dissociation of these ions occurs to an important extent on collision with neutral mols. O. D. S.

Nature of the effect of the sign of charge on ions in the C. T. R. Wilson cloud condensation experiments. A. F. KIP and L. B. LOEB (Physical Rev., 1936, [ii], **50**, 392).—Investigations with an improved form of cloud chamber of the original type used by Wilson show that the character of the companion impurity mols. making up the gaseous ion does not exert any marked influence on the sign preference in condensation by changing the v.p. of the drop. Vals. of the expansion ratios producing cloudy condensation in different org. vapours are recorded and discussed. L. S. T.

Nuclear moments of indium. S. MILLMAN, I. I. RABI, and J. R. ZACHARIAS (Physical Rev., 1938, [ii], **53**, 384—391).—Results obtained by the at. beam method of zero moments are: nuclear spin 9/2, hyperfine structure separation of the normal $^2P_{1/2}$ state 0·381 cm.$^{-1}$, abs. magnetic moment 6·40±0·20 nuclear magnetons calc. from measurement with high resolving power of the fine structure of the zero moment peaks. The theory of this effect is given. Peaks arising from the metastable $^2P_{3/2}$ state, lying 2212·6 cm.$^{-1}$ above the $^2P_{1/2}$ state, were found, and their intensity was in accord with quantum statistics. N. M. B.

Process of discharge and ionic efficiency in the positive-ray discharge. C. HAILER (Naturwiss., 1938, **26**, 156).—Electrons released from the cathode by bombardment with positive ions are not essential for the mechanism of the positive-ray discharge. A positive-ray tube suitable as a source of ions for at. transformation experiments is described. A. J. M.

Focussing and maximum energy of ions in the cyclotron. M. E. ROSE (Physical Rev., 1938, [ii], **53**, 392—408).—Mathematical. An investigation of the effect on the motion of the ions of the inhomogeneities of the electric and magnetic fields in the cyclotron. N. M. B.

Magnetic and electrostatic focussing in the cyclotron. R. R. WILSON (Physical Rev., 1938, [ii], **53**, 408—420).—Mathematical. A quant. study of the magnetic and electrostatic focussing on the basis of electric and magnetic field measurements shows that the relative importance of the two effects depends on the energy or path radius of the circulating particles. Probe measurements of the height of the beam are correlated to the calculations. N. M. B.

Stopping power of foils for high-speed deuterons. L. J. LASLETT (Physical Rev., 1936, [ii], **50**, 391).—The decrease in the range of the beam of deuterons of energy $\sim 5 \times 10^6$ e.v. from the Berkeley magnetic resonance accelerator produced by the interposition of different metallic foils (Al, Cu, Pt) has been measured. L. S. T.

Absolute values of the electron drift velocity in the rare gases. R. A. NIELSEN (Physical Rev., 1936, [ii], **50**, 386).—Vals. determined for N_2 and the rare gases have been compared with those predicted by the Compton mobility equation. The observed effects can be accounted for only by the occurrence of inelastic collisions of electrons with atoms or mols. L. S. T.

Ruthenium ammines. IV. At. wt. of ruthenium. K. GLEU and K. REHM (Z. anorg. Chem., 1938, **235**, 352—362).—Reasons are given for the opinion that "RuO_2" is a mixed oxide and that therefore the accepted at. wt. or Ru is too high. From the ratio $[Ru(NH_3)_5Cl]Cl_2$: Ru the at. wt. has been redetermined as 101·08±0·05. F. J. G.

At. wt. of europium. Analysis of europous chloride. G. P. BAXTER and F. D. TUEMMLER (J. Amer. Chem. Soc., 1938, **60**, 602—604).—The prep. of $EuCl_2$ is described; by analysis, the at. wt. of Eu is 151·96. $EuCl_2$ has d_4^{25-30} 4·87. E. S. H.

Abundance ratio of isotopes ^{12}C and ^{13}C in diamond. R. FRERICHS (Z. physikal. Chem., 1938, **181**, 355—358).—Spectrographic examination of CO_2 from diamond shows the latter to contain the isotopes in the same ratio in which they exist in other forms of C. F. L. U.

Isotopic ratio of neon. J. A. VREESWIJK, jun. (Physica, 1938, **5**, 202; cf. Diss., Utrecht, 1937).—The isotopic composition deduced spectroscopically, using a discharge tube in the end-on position, is in accord with that obtained by measurements of ρ. Inaccurate results are obtained by using a discharge tube viewed from the side. A. J. E. W.

Mass-spectrographic determination of the isotope abundance and at. wt. of rubidium. A. K. BREWER (J. Amer. Chem. Soc., 1938, **60**, 691—693).—Rb from different sources gives the ratio $^{85}Rb/^{87}Rb = 2·59–2·61$; the calc. at. wt. of Rb is 85·46. In old micas containing Rb the only isotope of Sr found is ^{87}Sr. The influence of the radioactivity of ^{87}Rb on the at. wt. of Sr is discussed. E. S. H.

Common forms of the periodic system of elements. A. VON ANTROPOFF (Ann. Guébhard-Séverine, 1937, **13**, 161—174).—The various arrangements of the periodic table are discussed, and a new form is put forward. A. J. M.

New substances of high emanating power and their application. I. P. PARCHOMENKO. **II.** F.

BĚHOUNEK (Coll. Czech. Chem. Comm., 1938, **10**, 54—59, 60—65).—I. Colloidal $Fe(OH)_3$ is an unsuitable carrier of radioactive substance as the emanating power falls rapidly. A const. val. is given by a dried SiO_2 gel containing Ra with $Fe(OH)_3$ together with the hydroxides of Mn, Ni, Co, Cr, Al, Zn, Mg, Ba, or Sr.

II. The Ra–SiO_2 complexes retain their activity over a period of years. Loss of activity due to humidity or wetting is restored on drying, but contact with rubber must be avoided. F. R. G.

Ionisation balance in the atmosphere and the amount of radium emanation. J. CLAY and L. J. L. DEY (Physica, 1938, **5**, 125—128).—Atm. ionisation is caused by γ-radiation from the soil, cosmic rays, and Rn and its decay products. Ionisation due to the first two factors varies only slightly, amounting respectively to $1{\cdot}6I$ and $1{\cdot}66J$ at Amsterdam. The Rn content has been measured by observing the ionisation charge collected on an electrometer system; it varies with the time of day and the weather conditions, an average val. being 230×10^{-18}, with a variation of $\pm 110 \times 10^{-18}$, Curie per c.c.; the corresponding ionisation due to the Rn and its decay products is $4{\cdot}5 \pm 2{\cdot}25J$.

A. J. E. W.

Experimental distribution of the greatest intervals between the emissions of α-particles. J. BRENET and H. ARMAND (J. Phys. Radium, 1938, [vii], **9**, 73—80).—Two series of automatically registered curves of the emission of α-particles from Po are discussed from the point of view of the greatest intervals between the emissions. W. R. A.

Application of the absorption method to the determination of the upper limits of continuous β-ray spectra. E. E. WIDDOWSON and F. C. CHAMPION (Proc. Physical Soc., 1938, **50**, 185—195).—An objective method of treating absorption data to obtain the most reliable val. for the upper limit of continuous β-ray spectra is described. The effect of geometrical conditions, change of source intensity, and source thickness on the absorption curve and apparent upper limit is discussed. Feather's empirical equation connecting range R and energy E of β-rays, corr. in accordance with recent data, is $R = 0{\cdot}536E - 0{\cdot}165$. The method was applied to results obtained for Ra-E and Th-C and to the β-ray spectra of ^{27}Mg, ^{31}Si, and ^{76}As, and gave vals. in good agreement with those obtained by other methods.

N. M. B.

Determination of the specific charge of β-particles. C. T. ZAHN and A. H. SPEES (Physical Rev., 1938, [ii], **53**, 357—365; cf. A., 1937, I, 595).—A modified Bucherer–Neumann method of determining e/m for β-particles is described. The behaviour of electrons in crossed fields inside a shallow condenser is discussed. A semi-graphical procedure is given for determining the shape and intensity of the peaks observed by the Geiger counter as the voltage on the condenser is varied. N. M. B.

Heavy β-particles? C. T. ZAHN (Physical Rev., 1938, [ii], **53**, 431—432).—A mathematical analysis of the modified and of the original unmodified Bucherer–Neumann experiments (cf. preceding abstract) indicates that the ordinary interpretation of such experiments cannot be justified. Further considerations on this basis opposing the existence of heavy β-particles are given. N. M. B.

Specific charge of disintegration electrons from radium-*E*. C. T. ZAHN and A. H. SPEES (Physical Rev., 1938, [ii], **53**, 365—373).—A more accurate investigation of results previously reported (cf. A., 1937, I, 595) using an improved method (cf. preceding abstract) is described. The central peak was so sharp that it could be located to within 0·1% of the voltage at the peak. The final corr. val. of e/m agreed with the theory of relativity to within 1·5%. Results do not support the hypothesis of "heavy electrons." N. M. B.

Complete detection of β-particles. S. C. CURRAN (Phil. Mag., 1938, [vii], **25**, 393—416).—The conditions for operating a Geiger counter for high efficiency in detection are described. It is desirable to work with the case at a negative potential with respect to the point. H. J. E.

Scattering of fast β-particles in nitrogen. I. E. G. STEPANOVA (Physikal. Z. Sovietunion, 1937, **12**, 550—560).—The single scattering of β-particles from Ra-C (energy ranges 200—1100 e.kv. and 1500—3000 e.kv.) in N_2 has been investigated. The distribution curve of scattered β-particles against scattering angle lies well above that calc. by Mott's method, especially for the greater energy range. In the lower range the effective cross-sections are approx. twice as great as the theoretical vals., and for the upper range 12 times as great. The discrepancy is affected not only by energy difference, but also by scattering angle. A. J. M.

Excitation of γ-rays by neutrons. II. Interaction of neutrons with protons. S. KIKUCHI, K. FUSHIMI and H. AOKI (Proc. Phys.-Math. Soc. Japan, 1936, **18**, 35—49).—The cross-section for the process of interaction of a proton and a neutron was between 0·36 and $1{\cdot}0 \times 10^{-25}$ sq. cm.

CH. ABS. (e)

Wave-length of secondary γ-radiation accompanying anomalous absorption of hard γ-rays. K. T. TUNG (Sci. Rep. Nat. Tsing Hua Univ., 1935, **3**, 85—93).—The absorption coeff. of the secondary γ-radiation associated with the anomalous absorption of Th-C'' γ-rays was determined for the scattering angle 120° for Al, Zn, Sb, and Pb. λ deduced from the absorption coeff. was 25·4 X for Al and Zn. For Sb and Pb there was a harder component of λ 13·8 X. The soft and hard components were attributed to positron and electron annihilation and to continuous X-rays produced by scattered electrons and positrons, respectively. CH. ABS. (e)

Nuclear selection rules. C. D. ELLIS (Proc. Physical Soc., 1938, **50**, 213—216).—An investigation of the intensity of a 3·2 m.v. γ-ray regarded as emitted in the disintegration Th-$C'' \rightarrow$ Th-Pb, by comparing the no. of recoil protons from D_2 with those due to the 2·62 m.v. γ-ray, indicates that 1—3 quanta of the harder ray are emitted for every 100 quanta of the 2·62 m.v. ray. This result supports the view that experimental spin vals. capable of

consistent use in different sets of selection rules can be assigned to the various nuclear states. N. M. B.

Emission of neutrons from argon, chlorine, aluminium, and some heavier elements under α-particle bombardment. E. POLLARD, H. L. SCHULTZ, and G. BRUBAKER (Physical Rev., 1938, [ii], **53**, 351—356; cf. A., 1937, I, 107).—The emission of neutrons from Cl, A, Sc, Ti, Mn, and Fe under α-particle bombardment is established. The yield from A is large, and consists of two groups, the larger being associated with an energy change of $-5{\cdot}6\pm1{\cdot}0$ m.e.v. Excitation curves and nuclear radii are discussed in relation with experimental data. N. M. B.

Absorption of slow neutrons in boron and lithium and the 1/v law. F. NORLING and R. FLEISCHMANN (Z. Physik, 1938, **108**, 483—490).—Attenuation coeffs. μ^B and μ^{Li} are measured for parallel neutron radiation of various energies. The relation between μ^B and μ^{Li} is linear within experimental error and over an extended energy range the ratio of the mass absorption coeffs. is 5·5, and the absorption cross-sections 8·6. L. G. G.

Absorption of *C*-neutrons in silver, cadmium, and boron at different temperatures. A. I. LEIPUNSKI and L. RUSINOV (Physikal. Z. Sovietunion, 1937, **12**, 561—578).—The absorption of *C*-neutrons in Ag, Cd, and B was investigated with Ag as detector, and for B with a B-lined ionisation chamber as detector. The neutrons passed through liquid H_2, or paraffin wax at 20·4°, 77°, and 300° K., H_2O at 300° K., or paraffin oil at 463° K. The results agree with the hypothesis that *C*-neutrons have chiefly thermal energy, but the energy distribution deviates from Maxwell's law, particularly at low temp. The results also agree with the theoretical $1/v$ law for the absorption of slow neutrons in B and Ag. A. J. M.

Heavy electron spectra. A. H. COMPTON (Physical Rev., 1938, [ii], **53**, 431).—Calculations support the view that Jauncey's "heavy electron" spectral image (cf. A., 1938, I, 168) is that due to electrons once scattered by the lower plate of the velocity selector. N. M. B.

Radioactivity produced in scandium by fast neutrons. W. E. BURCHAM, M. GOLDHABER, and R. D. HILL (Nature, 1938, **141**, 510).—Bombardment of Sc with 14 m.e.v. neutrons from Li bombarded with 950 kv. deuterons gives the 52 and 4 hr. periods with similar initial intensities, and the emission of positrons. This confirms the view that these periods must both be ascribed to ^{44}Sc and not to ^{44}Sc and ^{43}Sc as maintained previously, and that the ^{44}Sc nucleus exists in two isomeric forms of these half-lives, respectively. The radioactivity observed by Gentner (A., 1938, I, 170) and ascribed to ^{43}Sc in a $(\gamma, 2n)$ reaction should be attributed to ^{44}Sc in a (γ, n) reaction. L. S. T.

Slow neutron disintegration of ^{6}Li and the disintegration mass scale. M. S. LIVINGSTON and J. G. HOFFMAN (Physical Rev., 1936, [ii], **50**, 401).—Using slow neutrons from Rn + Be the reaction $^6\text{Li} + {}^1n \rightarrow {}^4\text{He} + {}^3\text{H}$ has been studied. The range of the ^{3}H is $5{\cdot}73\pm0{\cdot}05$ cm. under standard conditions. The total energy released is $4{\cdot}67\pm0{\cdot}05$ m.e.v. The val. derived for the quantity ^{2}H—^{4}He is $23{\cdot}58\pm0{\cdot}10$ m.e.v., which lies between recent mass-spectroscopic vals. Corr. masses for ^1n, ^{1}H, ^{2}H, ^{3}H, ^{3}He, ^{4}He, ^{6}Li, and ^{7}Li are given. L. S. T.

Production of ^{13}N. R. B. ROBERTS and N. P. HEYDENBURG (Physical Rev., 1938, [ii], **53**, 374—378).—The reactions $^{12}\text{C} + {}^1\text{H} \rightarrow {}^{13}\text{N} + h\nu$ and $^{12}\text{C} + {}^2\text{H} \rightarrow {}^{13}\text{N} + {}^1n$ (cf. Hafstad, A., 1935, 1297) were investigated and the abs. yield of positrons measured for various voltages. The proton capture reaction shows a single resonance of 30 kv. half width at 450 kv. which is compared with the Li and F resonance voltage scale (cf. A., 1936, 1313). A calculation of the yield of ^{13}N in the proton reaction from the yield of neutrons in the deuteron reaction (cf. Amaldi, A., 1937, I, 438) is made by comparison of the positron yields of the two reactions, but the evidence sought for *K* electron capture by the ^{13}N nucleus is inconclusive. N. M. B.

Absorption of ultra-radiation in various substances by counter-tube coincidences. A. SITTKUS (Z. Physik, 1938, **108**, 421—438).—When all secondary radiation and other possible disturbing influences are excluded it is found that for Pb, Fe, Al, C, and paraffin, const. absorption is obtained if the thickness of the material is inversely $\propto$ its density (*i.e.*, $\mu/\rho = \text{const.} = 5{\cdot}7 \times 10^{-4}$). This holds for thickness densities between 100 and 1000 g. per cm.^{2} Results agree with other workers' counter-tube measurements but show an unexplained divergence from ionisation chamber results. H. C. G.

Cosmic radiation and electrical conductivity in the stratosphere. O. H. GISH and K. L. SHERMAN (Physical Rev., 1938, [ii], **53**, 434; cf. Korff, *ibid.*, 14). N. M. B.

Scattering of cosmic-ray particles. E. J. WILLIAMS (Physical Rev., 1938, [ii], **53**, 433; cf. Neddermeyer, A., 1937, 1, 390).—Mathematical. Scattering theory is discussed in relation to the discrepancy between the energy lost by cosmic-ray particles in traversing Pb plates and the theoretical loss for electrons and protons. N. M. B.

Artificial radioactivity produced by cosmic rays in lead and iron. J. CLAY and K. H. J. JONKER (Physica, 1938, **5**, 171—174; cf. A., 1938, I, 9).—Immediately after covering or uncovering a Geiger counter, surrounded with Pb, with a Pb screen, deviations of the no. of counts considerably in excess of the statistical max. deviation are observed; the deviation shows a half-val. period of 9 min., and is attributed to radioactivity induced by cosmic rays. A similar phenomenon with half-val. period 10 min. is observed using a counter surrounded with Fe. A. J. E. W.

New heavy particles of cosmic radiation. P. AUGER (Compt. rend., 1938, **206**, 346—349).—The nature of cosmic radiation is reviewed, and the occurrence of particles of mass intermediate between that of the electron and the proton, constituting the penetrating component of the radiation, is discussed. The mass of these particles, calc. from the no. (R) of secondary electrons produced by each, is approx.

100*m*; they possess ionising power, at high energies, approx. equiv. to that of an electron; their absorption $\propto$ the at. wt. of the absorbent. The secondary electrons, probably produced by electrons of high energy resulting from collisions of the particles with at. nuclei, are of low penetrating power (1 cm. of Pb). A. J. E. W.

Cosmic-ray intensities at great depths. V. C. WILSON (Physical Rev., 1938, [ii], **53**, 337—343).—Data at various points in a mine shaft up to 1408 m. H_2O equiv. are reported. The effective absorption coeff. decreases from 0·07 per m. H_2O at the surface to 0·0025 at the greatest depth. A plot of log intensity–log depth gives two straight lines, one from 20 to 250 and the other from 250 to 1418 m. H_2O equiv. Shower counts show a bend at 250 m., suggesting two types of penetrating rays both capable of producing showers. One type may consist of "heavy electrons" and the other of "neutrinos." N. M. B.

Ionising power of cosmic ultraradiation. E. STUHLINGER (Z. Physik, 1938, **108**, 444—453).—Hard cosmic primary radiation gives rise to 30—35 ion pairs per cm. (air at atm. pressure), whilst under the same conditions showers produce about 50 pairs. This is explained on the assumption that the former are composed of very fast protons. L. G. G.

Production of bursts of cosmic-ray ionisation from various materials. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1936, [ii], **50**, 395).—The rates of production of bursts $>1{\cdot}6 \times 10^5$ ion pairs from small thicknesses of Mg, Fe, and Pb have been measured. The rates of occurrence per atom approx. $\propto$ the (at. no.)^2 of the producer. L. S. T.

Magnetic storm and variation of cosmic rays. J. CLAY and E. M. BRUINS (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 215—216).—Cosmic intensities under 12 and 110 cm. of Fe have been recorded during a magnetic storm. An increase of intensity occurred before the decrease usually associated with such storms. A. J. E. W.

Recent progress in the understanding of atomic nuclei. G. BREIT (Rev. Sci. Instr., 1938, **9**, 63—74).—A lecture. N. M. B.

Recent results of nuclear physics. W. BOTHE (Nuovo Cim., 1937, **14**, 501—505).—A summary of work carried out in the author's laboratory on nuclear isomerism and resonance processes in exchange reactions between nuclei. O. J. W.

Spherical waves in the wave-mechanics of the photon. J. GÉHÉNIAU (Compt. rend., 1938, **206**, 653—655).—Theoretical. A. J. E. W.

Non-relativistic theory of particles with integral spin. A. PROCA (J. Phys. Radium, 1938, [vii], **9**, 61—66).—Mathematical. W. R. A.

Quantum mechanical interpretation of the Silberstein theory. T. NEUGEBAUER (Ann. Physik, 1938, [v], **31**, 540—550).—Mol. polarisability is the sum of two distinct effects, one of which is treated in the Silberstein theory and the other in quantum-mechanical theory. The calculation of polarisability in an inhomogenous field is discussed. O. D. S.

Energy loss of fast charged particles by pair creation. M. KOBAYASI and S. ÔZAKI (Sci. Papers Inst. Phys. Chem. Res., Tokyo, 1938, **34**, 321—331).—Theoretical. The average energy loss of charged particles on collision with atoms and creation of electron pairs is calc. A. J. M.

Distribution of metal-electrons in alkali metals. P. GOMBÁS (Z. Physik, 1938, **108**, 509—522).—Theoretical. In conjunction with the Ritz approximation method, a procedure is derived for the approx. calc. of the eigenfunctions for the valency electron in alkali metals and applied to metallic K. L. G. G.

Transmutation functions and the many-body model of the nucleus. H. A. BETHE and E. J. KONOPINSKI (Physical Rev., 1936, [ii], **50**, 1100).—A discussion. L. S. T.

Nuclear calculation. D. R. INGLIS (Physical Rev., 1936, [ii], **50**, 399—400).—A method of calculating nuclear properties, which consists in applying perturbation theory to the representation in which protons and neutrons have the wave functions of three-dimensional harmonic oscillators in a cartesian co-ordinate system, is compared with other methods. L. S. T.

Density of nuclear levels. J. R. OPPENHEIMER and R. SERBER (Physical Rev., 1936, [ii], **50**, 391).—Theoretical. L. S. T.

Significance of atomic entities in modern atomic structure. W. F. G. SWANN (J. Franklin Inst., 1938, **225**, 289—308).—A philosophical address. I. McA.

Construction of zero order wave functions for complex atoms. (MISS) B. SWIRLES (Mem. Manchester Phil. Soc., 1937—38, **82**, 21—28; cf. A., 1936, 266; 1937, I, 163).—Mathematical. An application of the Gray–Wills method is developed (cf. Physical Rev., 1931, **38**, 248). N. M. B.

Theory of elementary particles. G. WATAGHIN (Atti R. Accad. Lincei, 1937, [vi], **26**, 282—285).—Mathematical. O. J. W.

Application of the self-consistent field method to atomic nuclei. M. MATRICON (Compt. rend., 1938, **206**, 651—653).—Mathematical. A. J. E. W.

Mean free path of protons in the Universe. E. SCHRÖDINGER (Nature, 1938, **141**, 410). L. S. T.

Theory of proton and neutron showers. L. GOLDSTEIN (Compt. rend., 1938, **206**, 488—490).—Theoretical, based on the intranuclear gas model (cf. A., 1938, I, 115). A. J. E. W.

Proton–proton forces and the mass defect curve. R. SERBER (Physical Rev., 1936, [ii], **50**, 389—390).—The approx. constancy of the observed binding energy per particle indicates that proton–proton and neutron–neutron forces are a linear combination of the Wigner (ordinary) type and the Majorana (exchange) type. L. S. T.

Spectrum of manganese hydride, MnH. R. W. B. PEARSE and A. G. GAYDON (Proc. Physical Soc., 1938, **50**, 201—206).—Using an improved discharge tube, investigations previously reported (cf. A., 1937, I, 279) are extended under higher dispersion.

Vibrational quantum nos. are assigned to the bands, and the spectrum is discussed in relation to the spectra of other hydrides. N. M. B.

Rotational energy distribution of OH molecules from the λ 3064 band. (Miss) E. R. Lyman (Physical Rev., 1938, [ii], **53**, 379—383).—Photometric measurement of the λ 3064 band excited in the O_2–H_2 flame and in the Cu arc shows a thermal distribution of intensities from which temp. of 3275° and 6350° K., respectively, are calc. The spectrum excited in vac. tube discharges shows abnormal rotational energy varying with the pressure of H_2O vapour in the tube. No reduction of rotational energy could be obtained by addition of excess of foreign gas (He or A). N. M. B.

Spectrum of chromium chloride, CrCl. A. G. Gaydon and R. W. B. Pearse (Nature, 1938, **141**, 370).—The band spectrum observed by Mesnage (A., 1935, 1187) and attributed to CrCl agrees closely with the known spectrum of AlCl. The vibrational consts. given by him for the upper and lower electronic states of CrCl are too small. L. S. T.

Spectrum of lutecium monoxide. W. W. Watson and W. F. Meggers (J. Res. Nat. Bur. Stand., 1938, **20**, 125—128).—An expression is derived for the wave nos. of band heads of the mol. spectrum of LuO. A possible explanation is given for the singlet character of the LuO band heads in contrast to the doublets of the LaO spectrum. The vibrational frequencies for mols. of rare-earth monoxides are discussed. J. A. D.

Influence of added salts on the absorption spectra of aqueous cobalt chloride solutions. J. N. Pearce and L. R. Dawson (J. Chem. Physics, 1938, **6**, 128—130).—The effects of adding equal concns. of NH_4Cl, NaCl, KCl, LiCl, HCl, and $CaCl_2$ on the absorption spectrum of $CoCl_2$ have been investigated. The absorption band widens with increasing concn. of the added salt and the increase varies directly as the ionic charge and inversely as the ionic vol. of the added cation. Increased absorption and consequent colour changes accompany an increase in the degree of hydration of the added cation. Existing theories regarding the cause of the formation of the blue solutions are discussed and, in view of their inadequacy, a new theory is put forward. In dil. solutions the Co ions are completely hydrated and this solvent sheath prevents the close approach of Co and Cl ions. On adding a strongly hydrating cation the sheath is broken down and the Co and Cl ions become drawn more closely together by electrostatic attraction. This may lead to a distortion of the electronic system of the Co ion causing different absorption and hence different colour. W. R. A.

Light absorption of cobaltic complexes. A. von Kiss and D. von Czeglédy (Z. anorg. Chem., 1938, **235**, 407—426).—The extinction curves for a large no. of cobaltic complexes in H_2O at room temp. have been determined from 195 to 700 mμ. The results are discussed with reference to the structures of the complex ions. F. J. G.

Ultra-violet absorption spectra of the system MoO_3–NaOH in dilute solution. (Mme.) Z. Soubarew-Chatelain and A. Berton (Compt. rend., 1938, **206**, 669—671).—The absorption spectra between 2500 and 4000 A. of aq. solutions of $MoO_3,2H_2O$ and MoO_3,H_2O, containing varying [NaOH], have been photographed. With NaOH : MoO_3 = 1 the spectrum is similar to that of $Na_2Mo_2O_7$, solid and in aq. solution; with NaOH : MoO_3 = 2 the absorption limit occurs at much lower λλ, the spectrum resembling that of Na_2MoO_4. A. J. E. W.

Absorption of light by tetra-alkylammonium salts. G. Kortüm (Ber., 1938, **71**, [*B*], 695—702).—Examination of the absorption spectra of NPr^a_4Cl, NBu^a_4Cl, tetra*iso*amylammonium chloride, NEt_4I, and $NEt_4{\cdot}NO_3$ shows that the absorption max. of NR_4^+ ions observed by Samuel (A., 1936, 921) is due to impurities in the preps. since it cannot be assumed that excitation of the C-N electrons occurs only when Alk is > Et. The theoretical conclusions with regard to the structure of electrolytic solutions based on the mutability of these bands with change of anion or addition of foreign salts are baseless. Beer's law is not obeyed by $NAlk_4I$ even in very dil. solutions and this behaviour is best explained by the relative decrease of I^- with increasing concn. Samuel's assumption of the formation of undissociated mols. with covalent N^V is improbable since a similar effect is not observed with the corresponding nitrate; also, it contradicts the universal experience that a co-ordination no. >4 does not occur in the second series of the periodic system, obviously for steric reasons. It is also possible that chemical action occurs between cation and anion with formation of $NAlk_3$ and AlkI without production of stable, undissociated mols. $NAlk_4I$. H. W.

Ultra-violet absorption bands of ethyl alcohol, *n*-propyl alcohol, and *n*-butyl alcohol in relation to magneto-optical dispersion. W. J. G. Beynon (Phil. Mag., 1938, [vii], **25**, 443—455).—Absorption bands were observed for EtOH vapour at λλ 1518, 1633, 1611, and 1602, for Pr^aOH at 1565, and for Bu^aOH at 1577 A. There was absorption below 700 A. in each case. The magneto-optical dispersions are calc. H. J. E.

Ultra-violet absorption bands of methyl alcohol and allyl alcohol and their relation to magneto-optical dispersion. W. J. G. Beynon and E. J. Evans (Phil. Mag., 1938, [vii], **25**, 476—488).—MeOH showed regions of banded absorption at λλ 1590 and 1470 A. The bands showed evidence of fine structure. There was also absorption below 700 A. Allyl alcohol exhibited two very broad diffuse bands, centres at approx. 1650 and 750 A., respectively. These results are correlated with magneto-optical measurements (cf. A., 1929, 1365). H. J. E.

Electrometry and ultra-violet spectrography of croconic acid. Comparison of constitutions of croconic and rhodizonic acid. G. Carpéni (Compt. rend., 1938, **206**, 601—603).—For croconic acid electrometric titration curves indicate acidic functions stronger than those of rhodizonic acid, with p_K 2·93±0·03 and 4·05±0·05 and $p_{K'}$ (corr.) 2·17±0·03 and 4·00±0·05; the p.d., unlike those with rhodizonic acid, were stable. At $p_H \leqslant 0$ the band at λ 3000 A.

corresponds with the undissociated mol., at $p_H > 1$ and < 3 the band at λ 3300 A. is due to the first dissociation, and at p_H 3—14 the band λ 3630 A., most intense of the three, is due to the bivalent croconic anion. The structures of croconic and rhodizonic acids are compared. (Cf. A., 1938, II, 147.) R. S. B.

Absorption spectra of organic substances in concentrated sulphuric acid. II. Substances without strong chromophores, hydroxycarboxylic acids, benzene derivatives. F. BANDOW (Biochem. Z., 1938, **296**, 105—120; cf. A., 1938, I, 59).—Many saturated aliphatic compounds (mono- and poly-hydric alcohols, hexoses, monocarboxylic acids, NH_2-acids, ethers, esters, amines, and amides) exhibit little or no absorption in the region 2500—7200 A. Some hydroxycarboxylic acids exhibit strong absorption bands in the ultra-violet, the absorption being > in H_2O. Many simple C_6H_6 derivatives exhibit marked absorption which is frequently different from that exhibited in neutral solvents. H_2SO_4 may be used with advantage as solvent in the spectroscopic detection and determination of certain org. compounds. W. McC.

Photographic infra-red absorption spectrum of heavy acetylene (C_2HD) and internuclear distances in the acetylene molecule. G. HERZBERG, F. PATAT, and H. VERLEGER (Physical Rev., 1936, [ii], **50**, 386).—New C_2HD bands have been observed with an absorbing length of 16·5 m. of 50% heavy acetylene. Previous vals. (A., 1935, 10) for the internuclear distances in the C_2H_2 mol. are confirmed (cf. A., 1934, 1288). L. S. T.

Quantitative analysis of infra-red absorption of fifty-five hydrocarbons. F. W. ROSE, jun. (J. Res. Nat. Bur. Stand., 1938, **20**, 129—157).—The near infra-red absorption curves previously published for 54 hydrocarbons (cf. A., 1937, I, 549) have been analysed mathematically. This leads to a quant. method of estimating the no. of different structural groups in an unknown hydrocarbon mol. of which the mol. wt. and C, H composition is known. The hydrocarbons studied consist of structural units $-CH_3$, $>CH_2$, $\geqslant CH$, $\geqslant CH$ (aromatic) which have their max. absorption at different λ. If K is the total molal absorption index, $K = n_a\alpha + n_b\beta + n_c\gamma + n_d\delta$ where n_a, n_b, n_c, n_d, are the no. of respective units in the complete hydrocarbon and α, β, γ, δ are their respective absorption indices. This equation holds for the normal paraffins, $C_{10}H_8$, aromatic hydrocarbons, and some of high mol. wt., but does not hold accurately for lower members of the normal and *iso*-paraffins. The method is used to identify an unknown isomeric nonane. J. A. D.

Isotope effect in the vibration spectrum of carbon tetrachloride. C. K. WU and G. B. B. M. SUTHERLAND (J. Chem. Physics, 1938, **6**, 114—118).—From consideration of the fine structure of certain Raman lines of CCl_4 Langseth (A., 1931, 1353) postulated a lack of symmetry in the four C valencies. This is now accounted for as an isotope effect. W. R. A.

Spectrum of hydrogen cyanide in the photographic infra-red. E. LINDHOLM (Z. Physik, 1938, **108**, 454—458).—The rotation–vibration absorption spectrum of HCN has been examined with a concave grating apparatus of high dispersion over the range 5900—10,500 A. Absorption thicknesses of HCN between 14 and 55 m. were employed at pressures between 250 and 580 mm. Of the 5 new bands observed, 2 were higher harmonics and the other 3 have an excited transverse vibration as lower state. These are analogous to bands observed in C_2H_2. New consts. in the nuclear vibration formula are calc. H. C. G.

Infra-red absorption spectra and molecular structure of cyanic acid, formic acid, and methyl alcohol. G. HERZBERG and H. VERLEGER (Physical Rev., 1936, [ii], **50**, 390).—The bands found are HCNO 10,310 A., HCO_2H 9800 A., and MeOH 9490 A. with well-resolved fine structures. The three NCO atoms do not lie on a straight line. The HCO_2H band is simple, indicating that the mol. is practically a symmetrical top. The MeOH band is comparatively simple and is interpreted as a 11 band; the calc. moment of inertia agrees with that expected for a moment of inertia about an axis perpendicular to C–O. L. S. T.

Hydroxyl frequency in carboxylic acids. M. M. DAVIES and G. B. B. M. SUTHERLAND (Nature, 1938, **141**, 372—373).—At room temp. the infra-red absorption spectrum of BzOH in CCl_4 shows a weak band at $2{\cdot}837 \pm 0{\cdot}003$ μ., the intensity of which increases with a rise in temp. to 75°, corresponding in behaviour with the 2·76 μ. band of the alcohols and indicating an increase in concn. of monomeric mols. at the higher temp. The shift in position of the characteristic OH absorption from 2·76 to 2·84 μ. distinguishes the OH in a carboxylic acid from that in an alcohol. AcOH gives similar results, but with $CCl_3{\cdot}CO_2H$ the monomeric OH frequency shifts to $2{\cdot}860 \pm 0{\cdot}003$ μ. This indication of a weaker OH linking presumably corresponds with the behaviour as a stronger acid than AcOH. $CCl_3{\cdot}CO_2H$ also gives a broad band near 3·3 μ., the intensity of which decreases with a rise in temp. This is probably an "association band" corresponding with that in the alcohols at approx. 2·95 μ. The variation in the monomeric OH band is also obtained by varying the concn. of the acid in the solvent and measuring the integral absorption. L. S. T.

Infra-red absorption studies of hydrogen linkings between unlike molecules. W. GORDY (J. Amer. Chem. Soc., 1938, **60**, 605—612).—Transmission curves for MeOH in $PhNO_2$ for the region 2·5—3·7 μ. have been determined and the effects of $PhNO_2$ on the OH band compared with those of other solvents. The influence of H linking on the OH band is discussed. Transmission curves for MeCN–H_2O and dioxan–H_2O mixtures have been obtained. Curves for D_2O–$COMe_2$ and D_2O–dioxan mixtures show evidence of the formation of D linkings. Certain bands of $COMe_2$, EtOAc, Et_2O, and dioxan are displaced towards lower frequencies by $CHCl_3$. The possibility of the formation of H linkings between $CHCl_3$ and these liquids is discussed. E. S. H.

Influence of the solvent on the infra-red absorption spectra of some solutions of neodymium

and samarium salts of acetylacetone. (MLLE.) M. RADOIČIČ (Compt. rend., 1938, **206**, 335—337).—λλ of absorption bands in the range 6000—12,000 A., for solutions of $Nd(C_5H_7O_2)_3$ and $Sm(C_5H_7O_2)_3$ in a no. of org. solvents, and for aq. solutions of $Nd(EtSO_4)_3$ and $Sm(EtSO_4)_3$, are recorded and discussed. The intensity and λ changes of the bands in different solvents are analogous to those observed in the visible spectrum (A., 1937, I, 393). A. J. E. W.

Complexity of the CH= bands of benzene derivatives. Structure of benzene. P. BARCHEWITZ (Compt. rend., 1938, **206**, 512—514; cf. A., 1933, 1228).—The effect of mono- and di-substitution on the bands (6000 to 10,000 A.) is described; with PhX (except $PhNO_2$) and o-C_6H_4XY simple displacement of the bands occurs; with m-C_6H_4XY the displacement is larger and the bands become dissymmetric; with $PhNO_2$ and p-C_6H_4XY, doubling of the bands is observed. This doubling is attributed to the "fixing" of an asymmetric charge distribution by the substituents, implying a three-fold charge symmetry in the C_6H_6 ring; this is not inconsistent with a six-fold symmetry of the masses in the ring. A. J. E. W.

Transmission of benzene derivatives in the far infra-red. M. PARODI (Compt. rend., 1938, **206**, 337—339).—λλ of absorption bands between 20 and 70 μ. are recorded for 15 halogenated C_6H_6 derivatives, and C_6Et_6, and the effect of the substituents on the λλ of the bands is discussed. It is suggested that mols. of C_6Cl_6, C_6Br_6, and probably C_6Et_6 possess a mode of vibration in which the C atom plane vibrates relatively to that of the halogen atoms. A. J. E. W.

Constitution of heavy water. I. R. RAO and P. KOTESWARAM (Nature, 1938, **141**, 331—332).—The Raman band of 99·6% D_2O has been investigated at temp. from 6° to 100°. Microphotometric curves of the bands for H_2O and D_2O at 30° show that with D_2O the components with max. at 2394, 2534, and 2674 cm.$^{-1}$ are better resolved, and the first component is approx. as intense as the second, whereas for H_2O the first component is less well resolved from and less intense than the second. Changes in the relative intensities of the three components of D_2O with temp. show that the structure of the band at any temp. is analogous to that for H_2O at a lower temp. These results indicate a difference in the relative proportions of the polymerides in D_2O and H_2O, and that characteristic temp. for D_2O should be higher than for H_2O. With a rise in temp. the component 2394 cm.$^{-1}$, attributed to $(D_2O)_3$, diminishes in intensity, the component 2534 cm.$^{-1}$, attributed to $(D_2O)_2$, remains unchanged, and the component 2674 cm.$^{-1}$, attributed to D_2O, increases correspondingly. L. S. T.

Raman spectra of liquid mixtures. III. Arsenic trichloride and antimony trichloride in alcohols and carbon sulphide. A. M. SAK and A. I. BRODSKI. **IV. Phosphorus trichloride and bismuth chloride solutions in various solvents.** A. I. BRODSKI and L. V. KORTSCHAGIN (J. Phys. Chem. Russ., 1937, **10**, 866—867, 868—871).—III. $Pr^{\beta}OH$ shifts the frequencies 372 and 410 cm.$^{-1}$ of $AsCl_3$ to 343 and 381; MeOH and EtOH shift $\nu = 321$ and 60 of $SbCl_3$ to 302 and 346, respectively.

IV. The PCl_3 spectrum is not affected by mixing with Et_2O, CS_2, or $CHCl_3$. The spectrum of $BiCl_3$ can be measured in aq. HCl only. The intensity of PCl_3 spectrum is measured; its lowering by $CHCl_3$ does not depend on ν. J. J. B.

Raman spectra of (A) various hydrochlorides, (B) some oximes. H. J. BERNSTEIN and W. H. MARTIN (Trans. Roy. Soc. Canada, 1937, [iii], **31**, III, 95—103, 105—113).—(A) The Raman spectra of $HgCl_2$, NH_2Me, NH_2OH, and C_5H_5N and their hydrochlorides have been obtained. The complex $HgCl_2,2HCl$ exists in solutions of $HgCl_2$ and HCl. In all cases the spectra of the hydrochlorides in solution are due to the respective ions $HgCl_4^{--}$, NH_3Me^+, NH_3OH^+, $C_5H_6N^+$. Results indicate that in the ion the atom or atoms bound to the parent mol., giving it the ionic charge, are not covalently linked but are held by forces which do not give rise to their own Raman lines but modify the spectrum of the original mol.

(B) The Raman spectra of Me_2 and Et_2 ketoxime and acetaldoxime have been obtained, and all show a band corresponding with OH (cf. A., 1937, I, 62). Structural formulæ for the unsymmetrical and symmetrical ketoximes are proposed and discussed. N. M. B.

Raman spectra of some inorganic compounds. C. S. VENKATESWARAN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 144—155; cf. A., 1937, I, 496).—Raman data, determined for $H_2TeO_4,2H_2O$, and for alkali and/or alkaline-earth salts of CrO_4'', MoO_4'', WO_4'', IO_4', HSO_4', ClO_3', BrO_3', IO_3', and N_3', both cryst. and in aq. solution, extend published results for AX_6, AX_4, AX_3, and X_3 anionic groups. νν are assigned to the normal modes, and force consts. calc. On passing from aq. solution to crystal, νν change slightly and line-splitting occurs, frequently by removal of degeneracy through ion distortion, but also with single symmetrical lines. The halates are pyramidal (A., 1935, 1301) with uniform angles ~54°; force consts. decrease as Cl → Br → I. AX_4 ions are tetrahedral. The linear unsymmetric structure of N_3' (A., 1935, 1194; 1937, I, 62) is confirmed in both states (contrast A., 1937, I, 15) by the new νν 636, 2066. The spectrum of $H_2TeO_4,2H_2O$ contrasts with those of H_2SO_4 and H_2SeO_4 (A., 1936, 1444) in indicating in both states the octahedral $Te(OH)_6$ structure, with ν 3121 characterising O–H groups involved in a H bond. I. McA.

Raman spectrum and structure of perrhenic acid and the perrhenate ion. R. FONTEYNE (Natuurwetensch. Tijds., 1938, **20**, 20—30).—From a study of the Raman spectra of $KReO_4$ and $NaReO_4$, solid and in solution, it is concluded that ReO_4' has a slightly deformed tetrahedral structure in the cryst. state but is octahedral in solution. The transition is observed as conc. solutions are diluted. The force consts. and frequency vals. of the infra-red-active oscillations are calc. for the two kinds of ion and compared with those for SO_4'', SeO_4'', TeO_4'', MoO_4'', WO_4'', and ClO_4'. The valency forces increase when the tetrahedral passes into an octahedral structure. S. C.

Raman effect in liquid ethylene. G. GLOCKLER and M. M. RENFREW (J. Chem. Physics, 1938, **6**,

170).—Liquid C_2H_4 at −120° exhibits 10 Raman displacements of which 9 have previously been recorded and 6 can be assigned to fundamental vibrations. A new frequency at 1601 cm.$^{-1}$ appears faintly and is produced by the same type of vibration as the strong line at 1621 cm.$^{-1}$ by mols. containing ^{13}C. W. R. A.

Raman spectra of sodium alkyl sulphonates and sulphinates. H. G. HOULTON and H. V. TARTAR (J. Amer. Chem. Soc., 1938, **60**, 544—548).—Raman shifts for Na Et (Pr, Bu, amyl) sulphinates and sulphonates are recorded. The data are in accordance with the structures NaO·S(R):O and NaO·S(R)(:O)$_2$. E. S. H.

***cis*- and *trans*-Isomerism.** J. CABANNES (J. Chim. phys., 1938, **35**, 1—15).—The Raman spectrum of CH_2:CCl_2 has been determined. Published vals. for the dichloroethylenes and for $(CH_2Cl)_2$, $CH_2Cl·CH_2Br$, and $(CH_2Br)_2$ confirm the symmetry C_{2v} for $(CHCl)_2$ (*cis*) and CH_2:CCl_2, and C_{2h} for $(CHCl)_2$ (*trans*). In the dihalogenated ethanes the *cis*- and *trans*-forms co-exist in the liquid at room temp. E. S. H.

Motion of ethylene halide molecules in crystals as revealed by the Raman effect. S. MIZUSHIMA and Y. MORINO (Bull. Chem. Soc. Japan, 1938, **13**, 182—189).—Solid $C_2H_4Cl_2$ at −40° shows a Raman frequency of 66 cm.$^{-1}$ in both Stokes and anti-Stokes lines, whilst $C_2H_4Br_2$ at −40° shows frequencies of 41 and 53 cm.$^{-1}$, and at 0° a frequency of 49 cm.$^{-1}$ It is suggested that these lines correspond with lattice frequencies, and that the change in frequencies for $C_2H_4Br_2$ occurs at the transition point (−24°), where unidimensional mol. rotation sets in. J. W. S.

Experimental study of chelation. I. Raman spectra of isomeric acetylphenols. G. B. BONINO, R. MANZONI-ANSIDEI, and M. ROLLA. **II. Raman spectra of some derivatives of resorcinol. III. Raman spectra of some aromatic aldehydes. IV. Raman spectra of 2 : 4-diformylresorcinol, 2 : 4-diacetylresorcinol, and 4 : 6-diacetylresorcinol. V. Some Raman lines which appear in the spectra of substances with a heterocyclic ring.** G. B. BONINO and R. MANZONI-ANSIDEI. **VI. Thermochemistry of acetylphenols and of acetylresorcinols.** G. B. BONINO, R. MANZONI-ANSIDEI and M. ROLLA (Ricerca Sci., 1937, [ii], **8**, Reprints, 3, 2, 3, 3, 3, 4 pp.).—I. The Raman spectra of COPhMe and of its *o*-, *m*-, and *p*-OH-derivatives have been measured. The line characteristic of the C–O group is at 1679, 1638, 1671, and 1658 cm.$^{-1}$, respectively, for the four compounds. The displacement of this line in both the *o*- and *p*-derivatives shows that the displacement in the former is not solely due to chelation.

II. Raman measurements for resorcinol diacetate (I), 4-acetylresorcinol (II), and 4-acetylresorcinol 1-allyl ether (III) have been made. The C–O frequency is at 1769, 1629, 1628 cm.$^{-1}$, respectively. The displacement of this line in (II) and (III) and the occurrence of an intense line at 1325—1327 cm.$^{-1}$ characteristic of condensed heterocyclic nuclei indicate that both these substances have a chelate structure.

III. The Raman spectra of PhCHO and of its *o*-, *m*-, and *p*-OH-, -Cl-, and -Me derivatives have been measured. The C–O frequency at 1696 cm.$^{-1}$ of PhCHO is appreciably displaced only in the case of the *o*-OH-derivative, for which chelation is to be expected.

IV. For all three resorcinol derivatives the Raman line at 1679 cm.$^{-1}$ of COPhMe is considerably displaced towards lower frequencies, and an intense line at 1310—1330 cm.$^{-1}$, characteristic of condensed heterocyclic nuclei, is present.

V. Further evidence that the occurrence of a Raman line at 1310—1330 cm.$^{-1}$ is characteristic of a chelate structure is discussed.

VI. Thermochemical evidence for chelation is discussed. O. J. W.

Raman spectrum of naphthalene. R. MANZONI-ANSIDEI (Ricerca Sci., 1936, [ii], **7**, Reprint, 2 pp.).—The Raman spectrum of $C_{10}H_8$ in MeOH, $COMe_2$, and CCl_4 has been measured and compared with previous data. O. J. W.

Raman spectrum of opsopyrrole. R. MANZONI-ANSIDEI (Ricerca Sci., 1936, [ii], **7**, Reprint, 2 pp.; cf. A., 1933, 886).—Further measurements of the Raman spectrum of opsopyrrole with long exposures confirm the absence of the line at 1140 cm.$^{-1}$ characteristic of pyrrole. Some new lines have been found. O. J. W.

Raman spectrum of pyrrole-2-aldehyde. R. MANZONI-ANSIDEI (Ricerca Sci., 1937, [ii], **8**, Reprint, 1 p.).—Some earlier measurements (cf. A., 1934, 830) are confirmed. O. J. W.

Raman spectrum of *N*-acetylpyrrole and of 2 : 5-diacetylpyrrole. G. B. BONINO and R. MANZONI-ANSIDEI (Ricerca Sci., 1937, [ii], **8**, Reprint, 1 p.).—Further measurements of the Raman spectrum of *N*-acetylpyrrole (cf. A., 1933, 886) confirm the absence of the band at 3400 cm.$^{-1}$ due to the N–H linking. Some lines for the 2 : 5-Ac_2 compound are recorded. O. J. W.

Raman spectrum of *N*-phenylpyrrole and of *N*-phenylpyrazole. R. MANZONI-ANSIDEI and L. CAVALLARO (Ricerca Sci., 1937, [ii], **8**, Reprint, 1 p.).—Raman lines are recorded. The very intense line at 1140 cm.$^{-1}$ characteristic of pyrrole is absent in the phenylpyrrole spectrum. *N*-Phenylpyrazole gives a very intense line at 1522 cm.$^{-1}$ which cannot be attributed to either of the nuclei in the mol., but is probably due to a resonance interaction between the two nuclei. O. J. W.

Raman spectrum of 1-deuteroindene. R. MANZONI-ANSIDEI and E. LUCCHI (Ricerca Sci., 1937, [ii], **8**, Reprint, 2 pp.).—The Raman spectra of indene and of 1-deuteroindene have been measured and compared. Deuteroindene shows lines at 2293, 2182, 2164, and 2134 cm.$^{-1}$ which are absent in the indene spectrum and are characteristic of the C–D linking. Other differences are noted. O. J. W.

Raman spectrum of coumarone and of thionaphthen. R. MANZONI-ANSIDEI (Ricerca Sci., 1937, [ii], **8**, Reprint, 2 pp.).—The Raman spectra of

coumarone and of thionaphthen have been measured and compared with those of indene and of indole. O. J. W.

Raman spectrum of coumarin. C. S. VENKATESWARAN (Current Sci., 1938, **6**, 328—329).—Raman frequencies excited by 4046 and 4077 A. are recorded for cryst. coumarin (I). Lines are numerous, and include many intense lines in the region 1000—1500 cm.$^{-1}$, probably due to the rings in the mol. The C:O and C:C frequencies are split into doublets, 1595 and 1623, and 1709 and 1729 cm.$^{-1}$, respectively, having nearly the same intensity. The characteristic frequencies of C_6H_6 and $C_{10}H_8$ mols. appear more or less in the same position in (I). L. S. T.

Simple method for determining the polarisation of Raman lines. J. T. EDSALL and E. B. WILSON, jun. (J. Chem. Physica, 1938, **6**, 124—127).—A method for determining qualitatively the polarisation of Raman lines by polarising the incident light with "Polaroid" is described. The theory of the method is discussed and advantages and disadvantages over the standard method are reviewed. Results for AcOH, $COMe_2$, and EtOH are given. W. R. A.

Mechanism of chemiluminescence of 3-aminophthalhydrazide.—See A., II, 190.

Emission of radiation in chemical reactions. R. AUDUBERT (Angew. Chem., 1938, **51**, 153—163).—A review dealing particularly with the emission of ultra-violet radiation in a no. of reactions, the method of detecting it, and hypotheses concerning its origin. The application of radiochemical analysis to kinetics is illustrated by considering the radiation emitted in the slow oxidation of P, the anodic oxidation of Al, and the thermal decomp. of azides. A. J. M.

Luminescence and colour excited by radium in zinc borate glasses which contain manganese. B. E. COHN and S. C. LIND (J. Physical Chem., 1938, **42**, 441—452; cf. A., 1933, 446).—The thermoluminescence of Zn borate glasses exposed to Ra has a max. at 0·05% Mn, compared with 0·2% Mn when the excitant is ultra-violet light. The emission spectrum is the same in both cases. The production of a visible violet tint is observable at 0·02% and the depth of colour increases to a max. at 0·5% Mn. The coloration is accompanied by a general increase of absorption in the ultra-violet region, and the absorption curves for each λ exhibit max. at [Mn] which correspond with the luminescence optima, whence a close relation between the two phenomena is inferred. The initial visible and ultra-violet transparencies are almost completely restored by heating at or above 300°. F. L. U.

Kinetics of phosphorescence. D. BLOCHINZEV (Physikal. Z. Sovietunion, 1937, **12**, 586—601).—The kinetics of Lenard phosphors are discussed. Experiment shows that the emission of light from phosphors is of the nature of a bimol. reaction, being due to recombination of electrons and ions. It is shown that this does not disturb the thermal equilibrium of the electrons emitted. The experimental emission law can be explained if the process is regarded as a series of bimol. reactions, an hypothesis which is confirmed by an estimation of the recombination time of electron and ion. A. J. M.

Photosensitising action and fluorescence of uranium salts. J. WEISS (Trans. Faraday Soc., 1938, **34**, 451—456).—The quenching of fluorescence of U salts is discussed in terms of an electron transfer to the acceptor (cf. A., 1936, 793). An explanation is thus afforded of quenching by I′ and I′ + C_2O_4''. F. R. G.

Fluorescence spectrum of autunite. S. IIMORI and E. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 372—376).—When irradiated by ultra-violet light autunite, a hydrated phosphate of U and Ca, gives a fluorescence spectrum of 16 bands. 13 of these agree in λ with those of $Na(UO_2)PO_4$. T. H. G.

Interpretation of the properties of alkali halide–thallium phosphors. F. SEITZ (J. Chem. Physics, 1938, **6**, 150—162).—Long-λ absorption peaks not exhibited in the spectrum of the alkali halides are attributed to the excitation of the Tl ions. These are assumed to be distributed throughout the crystal occupying the places of alkali metal ions. The absorption spectra and fluorescence and phosphorescence effects are interpreted and distinction is drawn between the case in which the excited Tl ion has no Tl ions among its 12 positive ion neighbours and that in which one of the 12 is a Tl ion, and the variations in the results are discussed. W. R. A.

Some conditions for the occurrence of semiconduction. J. H. DE BOER (Chem. Weekblad, 1938, **35**, 197).—The reasons for the high sp. resistance of substances like NiO, Fe_3O_4, FeO, CoO, Cu_2O, CuI, WO_3, Ag_2S, ZnO, TiO_2, BaO, and NaCl, and the effects of a little oxidation and reduction, are discussed from the viewpoint of electron energy levels. S. C.

Electromotive force of the couple graphite–silicon carbide. M. DODERO (Compt. rend., 1938, **206**, 660—661).—The E–θ curve for a graphite–SiC couple shows a change of gradient at 700—900°. A Cu–SiC couple also gives a similar change at the same temp., and the thermal expansion of SiC shows an anomaly at 850—900°; the phenomena are thus probably due to an allotropic change in the SiC. The formula $\theta = 50 + 3{\cdot}32E$ (E being in millivolts) is valid only for graphite–SiC couples between 900° and 1300°. A. J. E. W.

Photoconductivity. N. F. MOTT (Proc. Physical Soc., 1938, **50**, 196—200).—Theory indicates that the primary photo-electric current in solids should tend to zero as the temp. is lowered, but the presence of trapped impurity-electrons may prevent this. Theoretical and experimental results for Ag and alkali halides are compared. N. M. B.

Resistance in selenium photo-voltaic cells. E. ELVEGÅRD, S. LINDROTH, and E. LARSSON (J. Opt. Soc. Amer., 1938, **9**, 36—39).—The variation of resistance of a Se cell with current, temp., and light intensity has been measured for currents in the same and opposite directions to the photo-electric current I_p. With increasing I in the direction of I_p, R increases to a max. and then decreases. With in-

creasing I in the direction opposite to I_p, R decreases. With increasing intensity of illumination, R is decreased and the max. in the R–I curve becomes less pronounced. The temp. coeff. of R is negative, from 0·3 to 3·1% per degree, and varies with I. O. D. S.

"Drift effect" in selenium photo-voltaic cells. E. ELVEGÅRD, S. LINDROTH, and E. LARSSON (J. Opt. Soc. Amer., 1938, **28**, 33—35).—The direction of the change which takes place in the photo-current of a Se cell during the first period (10 min.) of illumination depends on the λ of the light employed and on the temp. of the cell. The effect is apparently not due to fatigue. O. D. S.

Surface conductivity of ceresin-coated quartz. C. H. HOU (Rev. Sci. Instr., 1938, **9**, 90—91).—The surface conductivity of clear fused quartz in a humid atm. is increased, rather than undergoing an expected decrease, when the quartz is coated with a thin layer of ceresin wax. This is probably due to cracking, due to different coeffs. of expansion and slow penetration of H_2O mols. into minute cracks and spaces. N. M. B.

Dielectric losses in polar liquids and solids. S. O. MORGAN (Ind. Eng. Chem., 1938, **30**, 273—279).—The energy loss due to orientation of dipoles is a max. at a frequency related inversely to the time t of relaxation of the polar mols., but in liquids association occurs so that t has not a unique value. Assuming the vals. of t to be distributed about a most frequent val., the loss factor is calc. from the vals. of ϵ at low and at infinite frequencies and agrees with observed factors for a no. of liquids. Agreement is in general less close for solids but is sufficient to indicate that rotation of dipoles is possible. A. R. PE.

Conduction in polar crystals. I. Electrolytic conduction in solid salts. N. F. MOTT and M. J. LITTLETON. **II. Conduction band and ultra-violet absorption of alkali halide crystals.** N. F. MOTT. **III. Colour centres in alkali halide crystals.** R. W. GURNEY and N. F. MOTT (Trans. Faraday Soc., 1938, **34**, 485—499, 500—506, 506—511).—I. The polarisation around any lattice point in a polar crystal which contains an excess charge is calc. and used to obtain the work required to form ionic voids in alkali halides, whence the concn. of ionic voids, and hence the conductivity, is determined. Calc. are of the same order as observed vals.

II. The photo-electric threshold of rock-salt coloured by colloidal Na is in agreement with the val. calc. by the above method from ultra-violet absorption spectra.

III. Calculation of the energy of formation of ionic voids in alkali halides from the preceding work gives vals. in agreement with the theory of de Boer (A., 1937, I, 279). F. R. G.

Polar molecules in the earth's electric field as absorbers of wireless waves. M. C. HOLMES (J. Franklin Inst., 1938, **225**, 309—314).—H_2O mols. in the earth's field (E) act, in virtue of their dipole moment, as natural oscillators of ν $1{\cdot}3 \times 10^{10} \times \sqrt{E}$. Like electrons and ions, therefore, they may absorb (by resonance) and reflect (through the discontinuity in the anomalous dispersion region of the absorbing layer) the short wireless λ from 33 cm. upwards according to altitude. The "ceiling" heightens with increasing λ. A modified classical calculation, based on atm. data, yields the more than adequate absorption coeff. $k = 2{\cdot}8 \times 10^{-4}$ for ν of 10^8 cycles per sec. at ground level. I. McA.

Dielectric constants of gases under high pressure. M. KUBO (Bull. Chem. Soc. Japan, 1938, **13**, 167—173).—A term is derived which corrects the Debye equation for changes in pressure and is in accord with observed variations of dielectric polarisation and Kerr effect with temp. J. W. S.

Dielectric constants of boron trichloride and of arsenic trichloride in the vapour state. U. GRASSI (Nuovo Cim., 1937, **14**, 461—473; cf. A., 1933, 1231).—Measurements of ϵ for BCl_3 and $AsCl_3$ vapours at 300—470° have been made. For BCl_3 the val. of the mol. polarisation, P, calc. from ϵ agrees with that obtained from n, measurements of which are recorded. For $AsCl_3$ there is a considerable difference in the two vals. of P, and the val. of μ increases with temp. The results are compared with those previously found for PCl_3. O. J. W.

Dielectric properties of manganese ferrites. E. BLECHSCHMIDT (Physikal. Z., 1938, **39**, 212—216).—Determinations of the dielectric const. of mixtures of the binary system Fe_2O_3–MnO show that they have a high dielectric loss, which decreases considerably with increasing frequency and with decreasing $[Fe_2O_3]$. This is characteristic of insulators containing a high proportion of conducting particles surrounded by the insulator. A. J. M.

Quantum mechanical resonance and internal rotation. S. MIZUSHIMA and M. KUBO (Bull. Chem. Soc. Japan, 1938, **13**, 174—181; A., 1937, I, 396).—The dipole moment (μ) of MeOAc vapour is const. (1·696 D) over the temp. range 34·5—209·2°, whereas the val. of μ for Me_2CO_3 vapour increases and for $ClCO_2Me$ and $ClCO_2Et$ decrease with rise of temp. Comparison of the observed vals. with those calc. from the linking moments confirms that the strong resonance of the CO_2H group causes almost complete inhibition of the internal motion at ordinary temp., but that replacement of the H of HCO_2R by Cl or OMe greatly reduces the double linking character of the CO bond, so that rotation can occur about this linking. J. W. S.

Dipole moments of styrene derivatives. H. L. GOEBEL and H. H. WENZKE (J. Amer. Chem. Soc., 1938, **60**, 697—699).—The dipole moments of β-nitro-, β-nitro-*p*-methyl-, and β-cyano-styrene, cinnamic acid, Me cinnamate, cinnamamide, cinnamyl alcohol and chloride, and γ-phenyl-*n*-propyl alcohol, chloride, and bromide are: 4·27, 4·77, 4·14, 1·78, 1·93, 3·61, 1·79, 1·90, 1·71, 1·76, and 1·78 ($\times 10^{-18}$). The vals. are discussed in terms of the electromeric forms of the mols. E. S. H.

Dipole moments of benzil and stilbene dichloride. K. HIGASI (Bull. Chem. Soc. Japan, 1938, **13**, 158—166).—Assuming that the at. polarisation is 5% of the electronic polarisation, μ, in D, for benzil is 3·62 in C_6H_6 at both 25° and 50°, 3·52 and

3·46 in CCl_4 at 25° and 50°, respectively, and 3·45 in C_6H_{14} at 25°. This behaviour is not in accord with the ordinary formula for benzil, since the stable internal position should be a *trans*-configuration and hence μ should increase with rising temp. The behaviour observed is explained on Thiele's conception of a conjugated system and quantum mechanical resonance. μ for α-$(CH_2Cl)_2$ is 1·32 D in CCl_4 and 1·45 D in C_6H_6. These vals. are compared with corresponding data for $(CH_2Cl)_2$. J. W. S.

Dipole moment of pyridine. B. A. Middleton and J. R. Partington (Nature, 1938, **141**, 516—517).—The dipole moments at 20° of carefully-purified C_5H_5N in C_6H_{14}, *cyclo*hexane, CCl_4, C_6H_6, PhMe, and CS_2 are 2·21, 2·20, 2·33, 2·26, 2·25, and 2·10, respectively. The results indicate that the C_5H_5N mol. is more spherical than that of $PhNO_2$, and that in C_6H_6 and PhMe association with solvent mols. may occur. In CCl_4 a complex is probably formed. L. S. T.

Dipole moment, configuration, and reactivity of aromatic nitro-derivatives.—See A., 1938, II, 177.

Dielectric constant of paraffin at the m.p. S. Procopiu and V. Petresou (Ann. Sci. Univ. Jassy, 1938, **24**, 110—115).—The dielectric const. of liquid or solid paraffin increases with rising temp. During fusion, which occurs over a range of about 10°, there is a definite, but gradual, fall in dielectric const. E. S. H.

Polar group orientation in linear polymeric molecules. ω-Hydroxydecoic acids. W. B. Bridgman (J. Amer. Chem. Soc., 1938, **60**, 530—535).—Polyesters of ω-hydroxydecoic acid in dil. solution show no variation of dielectric const. with frequency in the region where dispersion is to be expected for mols. of such size. The sp. polarisation is independent of mol. wt. and the dipole moment $\propto$ mol. wt.$^{\frac{1}{2}}$. The behaviour is explained by supposing that the electrical unit orienting in the applied field is but a small portion of the mol. kinetic unit. The polyesters are considered as non-rigid, linear mols. E. S. H.

Valency and chemical compression of metals in combination with gold. W. Biltz and F. Weibke [with H. Ehrhorn and R. Wedemeyer] (Z. anorg. Chem., 1938, **236**, 12—23).—The characteristic increments of mol. vol. at 0° K. for Cs, Ba, and La in alloys with Au are 31, 28, and 21, respectively. F. J. G.

Propagation of light waves through ether. L. V. Gurjar (J. Univ. Bombay, 1937, **6**, Part II, 149—154).—Mathematical. A. J. E. W.

Effect of pressure on the absorption and optical activity of water. R. H. Zinszer (Physical Rev., 1936, [ii], **50**, 1097).—Experimental difficulties are examined. L. S. T.

Effect of longitudinal magnetic field on the refractive index and conductivity of ionised air. S. S. Banerjee and B. N. Singh (Nature, 1938, **141**, 511—512).—Graphs showing this effect are given. Experimental vals. agree with those calc. by means of new equations. L. S. T.

Refractive index and molecular refraction of light and heavy hydrogen sulphide. O. E. Frivold, O. Hassel, and E. Hetland (Physikal. Z., 1938, **39**, 224—225).—n of H_2S and D_2S for λ 4046·6, 4358·3, 4916·0, 5460·8, 5893·0, and 6562·9 A. has been determined and the mol. refraction calc. For λ 5460·8 A. $(n-1)\times 10^6$ for H_2S is $643{\cdot}50\pm0{\cdot}02$, and for D_2S, $640{\cdot}54\pm0{\cdot}02$. A. J. M.

Influence of temperature and pressure on the volume and refractive index of benzene. R. E. Gibson and J. F. Kincaid (J. Amer. Chem. Soc., 1938, **60**, 511—518).—The compressions of C_6H_6 have been measured at pressures up to 1250 bars and at 25—65°. The results are consistent with the Tait equation. The const. C in this equation is independent of temp.; the temp. variation of the const. B has been studied, and B has been fitted empirically into an equation of state of the van der Waals type. B is the difference between the a/v^2 and $RT/(v-b)$ forces in the liquid. The influence of pressure on n of C_6H_6 has been determined by matching against optical glasses; the results are in accordance with the Eykman sp. refraction formula. E. S. H.

Refraction of the halogenated methane derivatives containing one or more nitro-groups. J. M. Stevels (Trans. Faraday Soc., 1938, **34**, 426—428).—Calculation of bond refractions (A., 1937, I, 601) is extended to nitromethanes. F. R. G.

Theories of optical rotatory power. E. U. Condon (Rev. Mod. Physics, 1937, **9**, 432—457).—A survey. O. D. S.

Solvent action on optical rotatory power. II. The quadrupole field of the carbon disulphide type molecule. K. Cohen and C. O. Beckmann (J. Chem. Physics, 1938, **6**, 163—167).—Theoretical. An extension of previous work (A., 1937, I, 65) to quadrupole mols. of the type of CS_2. W. R. A.

Rotatory dispersion of sugars in liquid ammonia and in water. H. Shiba and S. Tanabe (Bull. Chem. Soc. Japan, 1938, **13**, 3—10).—A polarimeter tube of fused SiO_2 is described; it is provided with double end plates, the cavities in which are evacuated. The vals. of $[\alpha]$ have been determined at −35° to −70° for solutions of glucose, *d*-fructose, *d*-methyl-α-glucoside, sucrose, and lactose in NH_3, and the vals. compared with those for aq. solutions. J. W. S.

Thermal variation of the Cotton–Mouton constant for liquid aromatic hydrocarbons. C. F. Squire (Compt. rend., 1938, **206**, 514—515; cf. A., 1910, ii, 368).—The anomalous thermal variation of the const. for C_6H_6 is explained, assuming an electronic transition possible only in the liquid state. A. J. E. W.

Nomenclature of co-ordination compounds. (A) A. F. Richter. (B) S. Škramovský (Chem. Listy, 1938, **32**, 115—117, 117).—A discussion. R. T.

Novel type of isomerism in a co-ordination compound of copper. D. P. Mellor, G. J. Burrows, and B. S. Morris (Nature, 1938, **141**, 414—415).—The brown and blue cryst. species of $Cu_2(Ph_2MeAs)_3Cl_3$ (A., 1936, 1395) are probably iso-

merides. The brown is more stable than the blue, which in the dry state reverts to the brown after several months and more rapidly in $PhNO_2$. At 150° in $PhNO_2$ the brown form changes to the blue. Structures attributing tetrahedral co-ordination to Cu^{I} and square co-ordination to Cu^{II} are suggested. L. S. T.

Resonance in carbamide and its derivatives. II. Diamagnetic susceptibilities of thio-derivatives. A. Clow (Trans. Faraday Soc., 1938, **34**, 457—463).—Diamagnetic susceptibilities of $CS(NH_2)_2$ and 13 of its derivatives indicate that the structure changes from an amino-imino-structure (cf. A., 1937, I, 222) in $CS(NH_2)_2$ to a carbamide structure in a tetrasubstituted mol., in agreement with Werner (J.C.S., 1919, **115**, 1168). F. R. G.

NO^+ ion. L. J. Klinkenberg (Chem. Weekblad, 1938, **35**, 197—200).—The configuration of NO in various inorg. complexes is discussed. It is attached as a neutral mol. in unstable nitroso-compounds as $Fe(NO)SO_4$, as a negative ion in compounds like $Na_2[Fe(CN)_5NO],2H_2O$, and as a positive ion in "chamber crystals," which are formulated as acid nitrosyl sulphate, $(NO)^+HSO_4^-$. In general, HNO_2 acts like a base towards strong acids, forming acid nitrosyl salts. $(NO)ClO_4$, $(NO)SO_3F$, and $(NO)BF_4$ are isomorphous with the corresponding NH_4 salts. From comparisons of the mol. vols. and the identity of the powder diagrams of $(NO)ClO_4$ and $(OH_3)ClO_4$ it follows that in size, $(OH_3) = NO < (NH_4)$. The mol. complexes $SnCl_4,2NOCl$ and $PtCl_4,2NOCl$ are salts, $(NO)_2SnCl_6$ and $(NO)_2PtCl_6$, isomorphous with the corresponding NH_4 salts. All these compounds are heteropolar complexes. S. C.

Structural formulæ of ionic-crystalline compounds. V. M. Duganov (J. Gen. Chem. Russ., 1937, **7**, 2697—2703).—Theoretical. R. T.

States of the electrons of bivalent metals. K. Ariyama (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 344—356).—It is assumed that the two energy bands to which the valency electrons in bivalent metals belong overlap only slightly and that the holes in the lower as well as the electrons in the upper band behave as "nearly free electrons." The nos. of vacant and filled electronic states are semi-empirically determined for Be, Mg, Zn, Cd, and Hg; magnetic susceptibilities are calc. from the formulæ of Pauli and Peierls and are of the correct magnitude. T. H. G.

Nature of lattice oscillations in solid carbon dioxide. C. S. Venkateswaran (Current Sci., 1938, **6**, 378—379).—Theoretical. L. S. T.

Normal vibrations of ethylene halides. Y. Morino (Bull. Chem. Soc. Japan, 1938, **13**, 189—197).—The various vibration frequencies of ethylene halide mols. are analysed theoretically. J. W. S.

General connexion of different properties of the carbon–halogen bond in aliphatic compounds. J. M. Stevels (Trans. Faraday Soc., 1938, **34**, 429—432).—A summary of literature dealing with relationships between the strength of C–Hal. bond, $[R_D]$ for Hal., partial μ and restoring force const. of the bond, and the reactivity of Hal. (cf. A., 1938, I, 13, 121). F. R. G.

Continuous measurement of changes in the electronic work function during the fusion of tin. P. A. Anderson (Physical Rev., 1936, [ii], **50**, 386—387).—Continuous observation of progressive alterations in the work function of a metal surface down to time intervals of a few sec. can now be made. Applied to the change γ- to liquid Sn the method yields electron current–time curves similar to temp.–fusion curves. The results may indicate persistence of the regularly-oriented lattice structure of solid Sn beyond the m.p. The contact difference of potential between γ-Sn and $Sn_{liq.}$ is 0·17 v.; the latter has the lower work function. L. S. T.

Interpretation of the Senftleben effect. C. J. Gorter (Naturwiss., 1938, **26**, 140).—The connexion between the collision cross-section of mols. and mean free path may explain the effect of a magnetic field on the thermal conductivity and viscosity of O_2 and NO investigated by Senftleben (A., 1938, I, 22, 73). A. J. M.

Wave functions and permeabilities for a new type of potential barrier. R. P. Bell (Phil. Mag., 1938, [vii], **25**, 488—491).—Theoretical. H. J. E.

Intermolecular forces in two-dimensional systems. R. C. L. Bosworth and E. K. Rideal (Physica, 1938, **5**, 170).—A correction (A., 1938, I, 76). A. J. E. W.

Molecular potential energy. P. Guareschi (Atti R. Accad. Lincei, 1937, [vi], **26**, 398—402).—The relationship $U = (\pi/3)\gamma q^2$ is derived, where U = potential energy of two mols. in a liquid, γ = surface tension, and q = intermol. distance. O. J. W.

Van der Waals forces in helium. C. H. Page (Physical Rev., 1938, [ii], **53**, 426—430).—Mathematical. A variational method of calculating perturbation energy is applied to the first two terms of a rapidly converging series expansion of the mutual potential energy of two He atoms, and the result is compared with Margenau's simpler second-order perturbation scheme (cf. A., 1931, 1216). The method is then used with the perturbing potential in closed form. N. M. B.

Dissociation energy of the CN molecule. R. Schmid, L. Gerö, and J. Zemplén (Proc. Physical Soc., 1938, **50**, 283—292; cf. A., 1937, I, 494).—The dissociation energy is determined by the method of finding convergence limits of diat. mol. states by means of perturbations caused by the converging states on other states of the mol. The val. found for the dissociation energy of the CN mol. into C (^5S) and N (^4S) atoms is 8·09 e.v. N. M. B.

Surface tension of water from the velocity of capillary waves. V. E. Eaton (Physical Rev., 1936, [ii], **50**, 399).—Nine determinations for H_2O, by means of a ripple tank, gave the val. 72·64±0·03. L. S. T.

Parachor. I. Theoretical. II. Experimental measurements. R. Manzoni-Ansidei (G. Biol. Ind. Agr. Aliment., 1937, **7**, Reprints, 15, 19 pp.).—I. A method of calculating the parachor of hydrocarbons is outlined, in which consts. characteristic of radicals are mainly used instead of a combination of at. and structural consts. The following

parachor consts. are used: ·CH_3 55·1, >CH_2 40·1, :CH_2 37·5, ⩾CH (aliphatic) 22·5, ⩾CH (for unsaturated and aromatic substances) 21·7. For cyclic hydrocarbons additional consts. which depend on the amount of strain in the ring are used. Examples are given showing a close agreement between calc. and experimental vals. of the parachor for a no. of aliphatic, unsaturated, and aromatic hydrocarbons.

II. *d*, γ, and parachor vals. have been obtained for α-*d*- and *l*-pinene, *l*-limonene, sabinene, menthene, *l*-camphene, sabinane, *l*-pinane, pulegone, carvenone, carvone, β-thujone, menthone, fenchone, terpineol, eucalyptol, citral, linalool, geraniol, nerol, carvacrol, COPhEt, 1-$C_{10}H_7Cl$, 1-$C_{10}H_7Br$, 1-$C_{10}H_7Me$, Δ^2-dihydro-, tetrahydro-, and decahydro-naphthalene, and indene. O. J. W.

Comparison of the mixed-powder and substitution methods in the quantitative evaluation of *X*-ray reflexions from crystalline powders. J. C. M. BRENTANO (Proc. Physical Soc., 1938, **50**, 247—255).—An extension of a report previously published (cf. Brindley, A., 1938, I, 124), with special reference to the evaluation of at. scattering factors, to particle size, and to absorption and secondary extinction. A method of determining the presence of differential absorption is indicated, and techniques are discussed. N. M. B.

Scattering of *X*-rays by crystals with variable lamellar structure. L. LANDAU (Physikal. Z. Sovietunion, 1937, **12**, 579—585).—Mathematical. The distribution of intensities in *X*-ray lines due to scattering from crystals with variable lamellar structure (*i.e.*, planes of regular structure shifted with respect to each other) has been investigated. The shape of the spots in the Laue diagram and of the lines in a rotational pattern are examined. A. J. M.

Intensity distribution in the fibre diagram. Y. GO, S. NAGATA, and J. KAKINOKI (Bull. Chem. Soc. Japan, 1938, **13**, 198—210).—A formula is derived for the intensity distribution in the *X*-ray diagram of an ideal spiral fibre structure, including the ring fibre structure and the simple structure as special cases. The expression is compared with previous theoretical formulæ and with experimental data. J. W. S.

***X*-Ray photography of zero-order reciprocal net planes of a crystal.** W. F. DE JONG, J. BOUMAN, and J. J. DE LANGE (Physica, 1938, **5**, 188—192).—The theory and technique of a method of obtaining an undistorted image of the zero-order reciprocal net plane are described. All reflected rays reach the film by paths of equal length, and at a const. angle which may be varied to suit conditions. A. J. E. W.

Twin formation [in crystals] as a lattice geometry-theory of numbers problem, with application to some real cases. I, II. I. SCHAACKE (Z. Krist., 1937, **98**, 143—167, 211—232).—Mathematical. I. McA.

Hexagonal structure factors. C. A. BEEVERS and H. LIPSON (Proc. Physical Soc., 1938, **50**, 275—282).—Numerical data computed from formulæ are tabulated (cf. A., 1936, 1325). N. M. B.

Structure of solid helium. W. H. KEESOM and K. W. TACONIS (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 95).—Solid He, compressed in a thin-walled tube at 37 atm. and 1·45° K., shows a hexagonal structure with closest packing arrangement for the two atoms per cell, the distance between these two atoms being 3·57 A. The spacings of the 100 and 101 planes are 3·07 and 2·75 A., respectively, and $d = 0{\cdot}205$, in accord with the calc. vals. J. W. S.

Debye–Scherrer exposures of liquid helium. W. H. KEESOM and K. W. TACONIS (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 194, and Physica, 1938, **5**, 270—280; cf. A., 1937, I, 117, 224).—A liquid diffraction ring with an angle of deviation of 28° for Cu $K\alpha$ rays has been observed for He I at 2·5° K. and He II at 1·6° K. This corresponds with simple spherical mols. in He I; it is not in accord with London's diamond lattice for He II. The proposed structure is derived from the face-centred cubic lattice by omitting half the atoms, the "holes" forming channels; the unit cell contains 16 atoms, co-ordinates $\frac{1}{8}, \frac{1}{8}, \frac{1}{8}$; space-group T_d^2. A. J. E. W

Symmetry of ice. A. F. ROGERS (Amer. Min., 1937, **22**, 209).—A study of ice and snow crystals and their solution forms indicates, in agreement with *X*-ray investigations, that ice belongs to the dihexagonal pyramidal class (A_6·$6P$) of the hexagonal system. L. S. T.

Grain-growth of micro-crystals in drawn aluminium wire. T. FUJIWARA and Y. UMEMOTO (J. Sci. Hirosima Univ., 1938, **8**, 87—92; cf. A., 1936, 1326).—*X*-Ray examination was used to study effects of duration and temp. of annealing. Distortion is most marked near the circumference. Below 550° large single crystals are not formed. At 590° a nucleus forming near the circumference grows to a coaxial single-crystal ring. I. McA.

***X*-Ray diffraction halos on Laue photographs of drawn aluminium wire.** Y. SEIKI (J. Sci. Hirosima Univ., 1938, **8**, 99—102; cf. preceding abstract).—*X*-Ray examination shows, in addition to concentric diffraction rings, broad halos of progressive radial eccentricity from the *X*-ray centre spot as the area examined recedes from the wire axis. These are due respectively to random, and to oriented, distorted ultra-micro-crystals of limited life, produced by the drawing process. I. McA.

Orientation of single-crystal wire of aluminium. T. HUDITA (J. Sci. Hirosima Univ., 1938, **8**, 103—105).—The extent to which preferential orientation along the wire axis depends on drawing and annealing methods is examined by *X*-rays. I. McA.

Structure of metals. W. L. BRAGG and H. LIPSON (Nature, 1938, **141**, 367—368).—Müller's conclusion (A., 1938, I, 67) that lattice variations may occur in individual crystals of the order of 1/1000—1/2000 is criticised, and an alternative explanation of his results is put forward. Additional experimental evidence showing that crystal grains (in Cu) have identical spacings is described. L. S. T.

Crystal structure of compounds of the rare earths with metalloids of the fifth group. V. 1 : 1-Bismuth compounds. A. IANDELLI and E. BOTTI (Atti R. Accad. Lincei, 1937, [vi], **26**, 233—238; cf. A., 1938, I, 16).—LaBi, CeBi, and PrBi have a NaCl-type lattice, with a 6·565, 6·487, 6·448 A., respectively. O. J. W.

Structures of boron hydrides. IV. B_2NH_7 and $B_3N_3H_6$. Structure of dimethylamine. S. H. BAUER (J. Amer. Chem. Soc., 1938, **60**, 524—530; cf. A., 1938, I, 17).—Electron-diffraction investigations have confirmed a benzenoid structure for $B_3N_3H_6$; the B—N distance is 1·44±0·02 A. Data for $NHMe_2$ are: C—N 1·46±0·03 A., C—H 1·08±0·03 A., C–N–C angle 108±4°. The structure of B_2NH_7 is on the plan B–N–B. The mean B—N separation is 1·56±0·03 A., and the B–N–B angle is tetrahedral to within ±4°. E. S. H.

Structure of basic cadmium chlorides. W. FEITKNECHT and W. GERBER (Z. Krist., 1937, **98**, 168—179; cf. A., 1938, I, 91).—The intermediate phases $CdCl_2,Cd(OH)_2$ (I), $3CdCl_2,5Cd(OH)_2$ (II), $CdCl_{0·68-0·56}(OH)_{1·32-1·44}$ (III), $CdCl_2,4Cd(OH)_2$ (IV), and $CdCl_{0·26-0}(OH)_{1·74-2}$ (V), of the system $CdCl_2$–$Cd(OH)_2$ are examined by powder X-radiograms. In contrast to comparable Co^{II} and Ni^{II} systems (A., 1937, I, 225), mol. vols. decrease with fall in Cl′ content, and all lattices are of single-layer type, that of $CdCl_2$ for (II), that of $Cd(OH)_2$ for (III) and (V). The structure of Hoard and Grenko (A., 1934, 243) for (I) is confirmed. In (I) and (IV) anion exchange is regular, in (II) and (III) statistical; its nature and amount are characterised by the c/a ratio. I. McA.

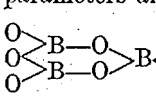
Diffraction of X-rays by gaseous silicochloroform. Geometric structure of the $SiHCl_3$ molecule. M. H. PIRENNE (Compt. rend., 1938, **206**, 516—517; cf. A., 1937, I, 14).—The mol. is pyramidal, with Cl—Cl 3·27±0·03, Si—Cl 1·98±0·02 A., Cl–Si–Cl 111·5±1°. A. J. E. W.

Crystal structure of valentinite (orthorhombic Sb_2O_3). M. J. BUERGER and S. B. HENDRICKS (Z. Krist., 1937, **98**, 1—30; cf. A., 1937, I, 447).—Rectilinear $(Sb_2O_3)_n$ macro-mols. are packed parallel to the c axis in a cellular structure maintained by secondary Sb–O_{II} links. In each mol., 2 sets of 2 parallel zig-zag strings of O_{II} (outer), Sb (inner), atoms are bridged by a straight line of O_I. Interat. distances and valency angles are given. I. McA.

Crystal structure of zinc meta-antimonate $Zn(SbO_3)_2$. G. L. CLARK and D. A. REYNOLDS (Z. Krist., 1937, **98**, 185—190).—Anhyd. $Zn(SbO_3)_2$ prepared by calcination of $Zn(NO_3)_2 + Sb_2O_3$ at 850° has a tetragonal body-centred unit cell containing 2 mols., with a 6·585 A., c/a 0·783, ρ ~6·3. Indexed visual intensities from a powder X-radiogram suggest positions for Sb and Zn involving the space-group $P\bar{4}n2$ and a planar SbO_3' anion. I. McA.

Structure of the sulphotellurides of bismuth. R. FEO and J. GARRIDO (Anal. Fís Quím., 1937, **35**, 242—248).—X-Ray measurements are recorded for tetradymite, Bi_2Te_2S, confirming the results of Harker (A., 1935, 17), and also for grünlingite, oruetite, joseite, and bismutinite. F. R. G.

Crystal structure of potassium acid dihydronium pentaborate $KH_2(H_3O)_2B_5O_{10}$, (potassium pentaborate tetrahydrate). W. H. ZACHARIASEN (Z. Krist., 1937, **98**, 266—274).—The rhombic unit cell contains 4 mols. with a 11·08, b 11·14, c 8·97 A.; space-group C_{2v}^{17} (Aba); ρ 1·74. With the aid of a Patterson analysis (A., 1935, 1193), complete at. parameters and interdistances are determined in fair agreement with visual intensities. The borate radical is $B_5O_{10}^{-V}$ as indicated; the O of the tetrahedral BO_4 (B—O 1·53 A.) form apices of BO_3 triangles (B—O 1·35 A.) which are linked in pairs by a common O. Adjacent radicals are linked through their 4 terminal O by H bonds (O—H—O 2·52 A.). The remaining 2 O form hydronium ions linked to K and (by OH bonds of ~2·79 A.) to 3 borate O. I. McA.



Higher hydrates of trisodium phosphate Na_3PO_4 and trisodium vanadate Na_3VO_4. G. L. CLARK and S. T. GROSS (Z. Krist., 1937, **98**, 107—111; cf. A., 1937, I, 185).—By rotation X-radiograms, $Na_3PO_4,12H_2O$ (I) and the isomorphous $Na_3VO_4,12H_2O$ are rhombohedral, probable space-group D_{3d}^4, with 12 mols. per cell and a 12·02, 12·16, c 12·66, 12·79 A., $\rho_{calc.}$ 1·58, 1·62, respectively. $2Na_3VO_4,NaF,19H_2O$, isomorphous with the corresponding phosphate (A., 1933, 1107), is cubic with a 28·27 A.; probable space-group O_h^8. Acicular crystals of a new unstable *hydrate* Na_3PO_4,nH_2O ($n \sim 16$) obtainable from supersaturated solutions of (I) gradually yield coaxial fibre patterns of, then powder diagrams of, (I). I. McA.

Classification and structure of silicates. H. STRUNZ (Z. Krist., 1937, **98**, 60—83; cf. A., 1937, I, 205).—Crystal class and structural formula of the type $[M^{IV}_wO_v|(O,OH,F)_w]M^{VI}_xM^{x}_y,zH_2O$ (I) where M are the 4-, 6-, and > 6-co-ordinated cations, O_v the tetrahedrally bound O, and $(\ )_w$ the intercalated anions, are given for some 200 silicates. A crystallo-chemical classification is based on (I), the main types (scaffold, layer, chain, group, island, and mixed) according with the modes of tetrahedral association. It differs from that of Niggli (A., 1933, 1001) in the inclusion in M^{IV} of P, As, Fe, etc. as well as of Si and Al, and in excluding M^{VI} from the electronegative bracket. The method is exemplified with rarer silicates. I. McA.

X-Ray study of isoprene, butadiene, and chloroprene at low temperature. C. J. B. CLEWS (Nature, 1938, **141**, 513).—At liquid N_2 and liquid O_2 temp., butadiene gives a good diagram with approx. 35 measurable lines, which, however, could not be identified with those of any of the crystal classes of high symmetry. Chloroprene gives diagrams showing 3 lines corresponding with spacings of 3·28, 2·57, and 2·32 A., and two diffuse "liquid" rings the max. of which correspond with spacings of 11·78 and 3·24 A. Isoprene gives only "liquid" rings with indicated spacings of 8·6, 2·4, and 2·0 A. L. S. T.

Fourier analysis of liquid methyl alcohol. G. G. HARVEY (J. Chem. Physics, 1938, **6**, 111—114).—X-Ray diffraction curves for liquid MeOH at 25°

and −75° have been determined and subjected to Fourier analysis. At −75° the detail in the diffraction curve is ≫ at the higher temp. Results agree with the picture of liquid MeOH suggested by Zachariasen (A., 1935, 572). W. R. A.

X-Ray investigation of the cubic modification of pentaerythritol. I. NITTA and T. WATANABÉ (Bull. Chem. Soc. Japan, 1938, **13**, 28—35).—Laue and Debye-Scherrer photographs indicate that at above the transition point (179·5°) pentaerythritol has a cubic structure with the central C atoms arranged in a face-centred cubic lattice of unit side 8·963 A. The layer structure of the tetragonal form disappears, but weakened H bonds still seem to exist, whilst the mol. becomes non-rigid owing to rotation about C·C linkings. This rotation probably accounts for the dipole moment of this mol. J. W. S.

Unit of structure and space-group of chloral hydrate. N. ELLIOTT (Z. Krist., 1937, **98**, 180).—The monoclinic cell contains 4 mols., with a 11·57, b 6·04, c 9·60 A., β 120° 7′; ρ 1·90; space-group C_{2h}^4. I. McA.

Electron diffraction. L. BRÚ (Anal. Fís. Quím., 1937, **35**, 107—139).—A review.

Interatomic distances of CCl_3F and CBr_3F. J. WOUTERS and M. DE HEMPTINNE (Nature, 1938, **141**, 412—413).—Electron diffraction gives for CCl_3F: Cl—Cl 2·94±0·03, Cl—F 2·56±0·04, C—F 1·44±0·04, C—Cl 1·76±0·02 A., and for CBr_3F: Br—Br 3·20±0·03, Br—F 2·70±0·02, C—F 1·44±0·06, and C—Br 1·91±0·04 A. The results show that the distance C—F remains practically const. in both compounds, the distance C—Cl has the same val. in all compounds containing CCl_3, except CCl_4, and that in going from CCl_3F to CBr_3F the pyramid CX_3 expands with a factor 1·088. L. S. T.

Electron diffraction in gases and molecular structure. J. A. A. KETELAAR (Chem. Weekblad, 1938, **35**, 195—197).—Electron diffraction experiments on aliphatic dibromides (C_4—C_{10}) show no preference for any particular configuration. The structure of NOCl and NOBr has also been investigated. The distances between N and halogen are Cl—N 1·95, Br—N 2·15 A. These abnormally large distances are interpreted as being due to resonance between normal covalent and ionic structures. Resonance between structures with single and doubly bound Cl in substituted ethylenes and benzenes is discussed in relation with quantum mechanical calculations on these phenomena. S. C.

Orientation in thin layers of stearic acid by electron diffraction. K. H. STORKS (Physical Rev., 1936, [ii], **50**, 396; cf. A., 1937, I, 172).—Electron diffraction patterns have been obtained from films of stearic acid (I) by both the reflexion and the transmission method. A single crystal of (I) on "rezoglas" gives a rectangular array of diffraction spots corresponding with the monoclinic α-modification. A crystal is always oriented with its [001] plane in the plane of the foil. Transmission patterns have also been obtained from (I) deposited on Au films. In reflexion experiments with (I) on Ni etc., diffraction patterns consist of diffuse spots forming broad bands inclined 33° to the surface plane, which must be the inclination of long hydrocarbon chains to the surface normal. Separations of these bands correspond with 2·5 A. spacing between C atoms. L. S. T.

High-frequency magnetic permeability of thin films of iron, on the hypothesis of a very thin, non-magnetic surface film. S. PROCOPIU (Ann. Sci. Univ. Jassy, 1938, **24**, 257—262).—Theoretical. The magnetic properties of Fe at high frequency are explained, assuming the existence of a non-magnetic surface film 35—70 mμ. thick. E. S. H.

Influence of compression on the magnetisation of nickel. S. VELAYOS (Anal. Fís. Quím., 1937, **35**, 107—123).—Hysteresis curves (cf. Heaps, A., 1936, 1055) have been obtained for 0—11 kg. per sq. mm. The limiting intensity of magnetisation (I), loss by hysteresis, coercive H_C, max. κ, and the corresponding H_M are related to the compression σ by $\sqrt{H_C} = 3·81 - 0·114\sigma$; $IH_C = 6220 - 284\sigma$; $\kappa = 3·06 + 0·323\sigma$; $H_M(\sigma + 7·8_9) = 181·_5$. F. R. G.

Anisotropy of the magnetic energy in single crystals of nickel as a function of temperature. N. L. BRUCHATOV and L. V. KIRENSKI (Physikal. Z. Sovietunion, 1937, **12**, 602—609).—Single crystals of Ni were obtained in spherical form, and the magnetic moment induced in them by a magnetic field was determined. The energy const. of the magnetic anisotropy of the crystal was calc. as a function of temp. The anisotropy const. varies with temp. according to the empirical equation $K = K_0 e^{-\alpha T^2}$ (K_0 and α being const.); this does not hold near the Curie point. The results agree with the theory of Akulov (A., 1937, I, 503). A. J. M.

Reversible change of thermal energy accompanying adiabatic change of magnetisation in nickel. T. C. HARDY (Physical Rev., 1936, [ii], **50**, 395).—Townsend's method (A., 1935, 572) has been improved to permit a study of the magneto-caloric effect in materials for which the total hysteretic energy increase is small in comparison with the reversible thermal energy changes that occur during a half-cycle of magnetisation. Results for Ni are given. L. S. T.

New determinations of gyromagnetic ratios for ferromagnetic substances. S. J. BARNETT (Physical Rev., 1936, [ii], **50**, 390).—New measurements on electrolytic Fe, cold-rolled steel, Ni, permalloy, Hopkinson's Ni–Fe alloy, Co, Co alloyed with Cu or Ni, and Preuss' Fe–Co alloy give vals. ranging from approx. $1·02 \times m/e$ for Ni–Fe to approx. $1·10 \times m/e$ for Co. L. S. T.

Reflecting power of evaporated metal films in the near and far ultra-violet. G. B. SABINE (Physical Rev., 1936, [ii], **50**, 396—397; cf. A., 1937, I, 634).—The reflecting power of evaporated metal films from the visible to 450 A. have been determined for Al, Sb, Be, Bi, Cd, Cr, Cu, Au, Fe, Pb, Mg, Mn, Mo, Ni, Pd, Pt, Ag, Te, Sn, Ti, Zn, and Zr. L. S. T.

Total reflecting power of nickel and an iron-cobalt alloy as a function of temperature in the neighbourhood of the Curie point. L. S. ORN-

STEIN and O. KOEFOED (Physica, 1938, **5**, 175—176).—The reflecting power of Ni shows a sudden decrease, and that of an Fe–Co alloy containing 22·5% of Co a slower increase, as the temp. is increased through the Curie point. A. J. E. W.

Ellipticity of light reflected from thin films of oriented molecules. H. A. MCTAGGART (Trans. Roy. Soc. Canada, 1937, [iii], **31**, III, 141—151).—The changes in the ellipticity of light reflected from a no. of mono-layers of Ba stearate on glass are examined and discussed. Experiments show that, when the incident light is plane polarised, films built up of oriented mols. on glass may be used to vary the ellipticity (from positive to negative vals.) of light reflected from them, and certain film thicknesses may be found which give plane polarised light at all angles of incidence. N. M. B.

Young's modulus in bismuth crystals. A. B. FOCKE, R. B. LINDSAY, and G. R. WILKS (Physical Rev., 1936, [ii], **50**, 872).—The modulus has been determined for the two principal crystallographic directions by measurements of the velocity of sound in a single-crystal rod soldered between two longer steel rods. The velocities for crystals with the principal axis perpendicular to and parallel to the rod are 2026 and 1541 m. per sec., respectively, giving $4{\cdot}04 \times 10^{11}$ and $2{\cdot}25 \times 10^{11}$ dynes per cm.^{2} for the moduli. L. S. T.

Elastic property of metallic wire at high temperature. T. FUJIWARA and T. HUKUDA (J. Sci. Hirosima Univ., 1938, **8**, 93—98).—Elasticity–temp. curves in the range 600—3000° K. are determined for W wires (*d* 0·1 mm.) hanging freely in vac., by applying a horizontal magnetic field to give a standard lateral deflection of the current-heated wire. The curves show a slight linear decrease of elasticity followed at ~2100° K. by a marked trough (possibly due to plastic deformation) with its min. at 2650° K. I. McA.

Molecular processes at the elastic limit. A. SMEKAL (Physikal. Z., 1938, **39**, 228—230).—A finite elastic limit for the occurrence of irreversible mol. processes cannot be demonstrated. A. J. M.

Elastic constants of an anisotropic solid. M. S. PLESSET and R. F. BAKER (Physical Rev., 1936, [ii], **50**, 399).—Theoretical. L. S. T.

Elastic constants of anisotropic solids. Group-theoretical treatment. H. A. JAHN (Z. Krist., 1937, **98**, 191—200).—The elastic consts. of a solid number from 2 to 21 according to symmetry. By applying the theory of the irreducible representations of symmetry groups, the relations of Voigt for crystallographic groups are derived more simply, and an extension is made to cover all possible symmetry groups. I. McA.

Dilatometric study of the α–γ transformation in high-purity iron. C. WELLS, R. A. ACKLEY, and R. F. MEHL (Trans. Amer. Soc. Met., 1396, **24**, 46—66).—The temp. of the α–γ transformation of H_2-purified Armco Fe was $909{\cdot}5° \pm 1°$. The effects of supercooling, superheating, and speed of transformation were studied. CH. ABS. (*e*)

Self-sputtering at the cathode in the glow discharge. H. FISCHER (Z. Physik, 1938, **108**, 500—508).—Redeposition of sputtered material on the cathode surface has been demonstrated by direct experiment. Disturbance of equilibrium between fresh sputtering and redeposition has no effect on electron liberation at the cathode (γ-coeff.). Variations of the γ-coeff. and the condition of the cathode surface with alteration in discharge conditions were observed. H. C. G.

Transition phenomena in the condensation of silver vapour on clean and gas-covered tungsten. M. B. SAMPSON and P. A. ANDERSON (Physical Rev., 1936, [ii], **50**, 385—386).—Permanent condensation of Ag on a gas-covered W filament occurred only when the temp. was lowered to 900° K. and typical transition effects appeared. Permanent condensation on W cleaned by flashing at 2800° K. occurred at 1220° K. with no appearance of crit. phenomena. Crit. temp. effects in the condensation of metal on metal are probably conditioned by the presence of surface films of gas and vapour. L. S. T.

Electrical properties of thin metallic films. E. PERUCCA (Nuovo Cim., 1937, **14**, 506—524).—A summary of work on the electrical properties of metallic films which are $\gtrsim$100 A. thick. O. J. W.

Resistance of cuprous oxide in fields of high intensity. F. P. HENNINGER (Physikal. Z., 1938, **39**, 216—224).—The reistance of Cu_2O in the massive, finely cryst., and coarsely cryst. form has been determined when the substance is in an electric field of high intensity. Plates of finely cryst. Cu_2O obey Ohm's law up to a field strength of 90 kv. per cm. A coarsely cryst. plate has a resistance independent of potential up to 115 kv. per cm. A. J. M.

Electrical properties of manganese ferrites. A. SCHULZE and W. GREMMER (Physikal. Z., 1938, **39**, 205—208).—The effect of temp. on the sp. resistance of the binary system Fe_2O_3–MnO has been examined for mixtures containing various amounts of Fe_2O_3. At room temp. the sp. resistance is very high, but decreases with rising temp. until it reaches the val. for a badly conducting metal. Potential has a considerable effect on the resistance. The results are explained by the existence of intercryst. layers. A. J. M.

Variation in the resistance of an electrical conductor in a magnetic field. F. V. BERGEN (Compt. rend., 1938, **206**, 588—590).—Theoretical. The increase in resistance on applying a magnetic field has been studied and shown to agree with the experiments of Kapitza (cf. A., 1934, 721). R. S. B.

Resistance of a superconductor in the intermediate state. H. G. SMITH (Trans. Roy. Soc. Canada, 1937, [iii], **31**, III, 31—39).—Mathematical. N. M. B.

Superconductivity. F. LONDON (Z. Physik, 1938, **108**, 542—544).—Comments on Bopp's work (cf. A., 1938, I, 70). H. C. G.

Magnetochemical studies. XXIX. Magnetic behaviour of potassium manganate. K. A. JENSEN and W. KLEMM (Z. anorg. Chem., 1938, **237**,

47—48).—χ for K_2MnO_4 is $6{\cdot}03 \times 10^{-6}$ at 22° and $19{\cdot}6 \times 10^{-6}$ at −183°. This corresponds with 1·73 Bohr magnetons in agreement with theory for Mn^{VI}. F. J. G.

Magnetically neutral solutions. C. SALCEANU (Z. Physik, 1938, **108**, 439—443).—The relation between magnetic susceptibility and concn. is obtained for a no. of paramagnetic salts in H_2O. It is found that for any pair of paramagnetic ions $p_1/p_2=\sqrt{(c_2/c_1)}$ where p = Weiss magneton no. and c = concn. at which magnetic susceptibility is zero. L. G. G.

Active oxides and reactions of solid substances. CIX. Observation of the ageing processes in glassy substances by means of magnetic measurements. G. F. HÜTTIG and E. STROTZER (Z. anorg. Chem., 1938, **236**, 107—120).—The ageing processes in glasses at various temp. have been studied by measurements of χ, using three different kinds of glass, viz., a commercial glass and anhyd. $Na_2B_4O_7$, both of which had been rendered paramagnetic by addition of 10% of CoO, and a $CoO-B_2O_3$ glass. In the first two cases χ passes at first through a min. and then through a max. The min. is most pronounced at lower temp., and the height of the max. is greatest at higher temp., and both are reached more rapidly as the temp. rises. In the third case the initial min. is not observed and the max. has the same height at all temp. In this case the time required to attain a particular val. of χ is related to the temp. by the Arrhenius equation, and the activation energies for the processes which give rise respectively to the increase and the subsequent decrease of χ are 18,620 and 27,180 g.-cal. F. J. G.

New type of free radical. Paramagnetism of tritolylammonium perchlorate. P. RUMPF and F. TROMBE (Compt. rend., 1938, **206**, 671—673).—$[(C_6H_4Me)_3N]^+ClO_4^-$ (I) has $\chi_{sp.} = +2{\cdot}635 \times 10^{-6}$, $\chi_{mol.}$ (corr. for diamagnetism) $= +1247 \times 10^{-6}$, confirming that the ammonium cation may be considered as a free radical. Assuming that the mol. of (I) contains one free electron, Van Vleck's formula gives $\chi_{mol.} = 1296{\cdot}5 \times 10^{-6}$. A. J. E. W.

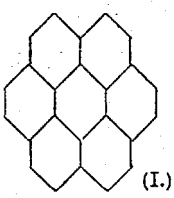
Stimulation of paramagnetic absorption by a constant field. F. BRONS and C. J. GORTER (Nature, 1938, **141**, 369).—Paramagnetic absorption in Fe alum is markedly stimulated at a frequency of $3{\cdot}7 \times 10^6$ and 77° K. in presence of a comparatively large const. field applied parallel to the alternating field. Absorption reaches a max. at 1000 oersted. L. S. T.

Magnetic susceptibility of molecular hydrogen. E. E. WITMER (Physical Rev., 1936, [ii], **50**, 1094).—Terms in the molar magnetic susceptibility equation have been evaluated for different internuclear distances. L. S. T.

Susceptibility of Gd, Tb, Dy, Ho, and Er ions and the Weiss magneton. I. B. CABRERA (Anal. Fís. Quím., 1937, **35**, 207—241).—The val. of the Weiss magneton is recalc. as 1125·0 (cf. A., 1937, I, 504). A satisfactory val. for the magnetic moment of $Tb^{\cdots}$ could not be determined (*loc. cit.*). F. R. G.

Diamagnetic anisotropy of conjugated compounds. (MRS.) K. LONSDALE (J.C.S., 1938, 364—368).—Diamagnetic susceptibility data are recorded for phthalocyanine, $H_2C_2O_4,2H_2O$, stilbene, tolan, and *trans*-Ph_2N_2, and, excepting for the last compound, are correlated with the mol. direction cosines from *X*-ray data to deduce the principal susceptibilities of the mols. The anisotropy of the C_2O_4 group is about twice that of the CO_3 group and about one sixth that of C_6H_6. Besides the anisotropy normal to the mol. plane, explained in terms of mol. orbitals, stilbene and tolan have unexplained anisotropy in that plane. Large diamagnetic anisotropy is associated with the existence of bond resonance, planar arrangement of atoms in the mol., and tendency to equalise bond distances, in open systems as well as in closed rings. J. W. S.

Diamagnetic anisotropy of an aromatic molecule. C. F. SQUIRE (Compt. rend., 1938, **206**, 665—667).—The diamagnetic anisotropy of (I) is calc. by the London method (A., 1938, I, 19). The val. obtained, $4{\cdot}56\Delta\chi_{C_6H_6}$, is only slightly > that for pyrene, $4{\cdot}46\Delta\chi_{C_6H_6}$. A. J. E. W.



(I.)

Ferromagnetism and structure of manganese ferrites. A. KUSSMANN and H. NITKA (Physikal. Z., 1938, **39**, 208—212).—*X*-Ray structure and magnetic properties of a series of manganese ferrites shows that ferromagnetism at high temp. is due to a stable mixed-crystal phase with a face-centred cubic lattice (spinel structure). The range of stability of this phase is examined. It is stable up to 1300°, and can be observed at room temp. by quenching the hot mixture, although it is then unstable. A. J. M.

Collision efficiency in the decomposition of nitrous oxide. L. KÜCHLER (Naturwiss., 1938, **26**, 104—105).—The determination of the direct transference of vibrational energy in the decomp. of N_2O has been carried out by investigating the dispersion of sound in N_2O–He mixtures up to 420°. The relaxation time for collisions between He and N_2O increases with rising temp. and at 420° is almost equal to the val. for pure N_2O. Extrapolation to 650° shows that about 2000 collisions with He are necessary to deactivate one mol. of N_2O. This is the same efficiency as is derived from kinetic experiments. A. J. M.

Determination of [acoustic] resonance points in liquids in tubes by deflexion of a galvanometer. C. SĂLCEANU and C. ISTRATY (Compt. rend., 1938, **206**, 329—330).—A device employing a microphone and valve amplifier is described. The nature of the resonances obtained with H_2O, EtOH, $COMe_2$, and CCl_4 is illustrated. A. J. E. W.

Formulæ for calculating the velocity of sound and the m.p. R. GIANASSO (Nuovo Cim., 1937, **14**, 486—491).—Formulæ are derived for calculating the velocity of sound in and m.p. of cryst. elements. These quantities are expressed as functions of a parameter v, which is defined as the no. of co-ordination charges or peripheral electrons belonging to each atom in the lattice. The formulæ are used to calculate v, which for some elements = no. of valency electrons. For most elements, however, v has several

vals. depending on the method of calculation, but some of these vals. always coincide with known valencies of the elements. O. J. W.

Absorption of sound in carbon dioxide gas. Determination of the relaxation time for the vibrational energy as a function of the temperature. A. VAN ITTERBEEK and P. MARIËNS (Physica, 1938, **5**, 153—160).—The absorption of sound in CO_2 as a function of pressure has been measured using frequencies of 304·4 and 598·98 ke., at a no. of temp. Vals. for the relaxation times and nos. of effective collisions are deduced. The results are in accord with Kneser's theory and the Kirchhoff–Helmholtz absorption formula. Mol. rotation appears to have no influence on the relaxation time. Traces of H_2O vapour considerably increase the absorption. A. J. E. W.

Sound velocity and chemical constitution [of organic liquids]. S. PARTHASARATHY (Current Sci., 1938, **6**, 322—323).—General findings are summarised. L. S. T.

Acoustic resonance spectra of liquids. C. SĂLCEANU and C. ISTRATY (Compt. rend., 1938, **206**, 502—504).—The occurrence of secondary resonances in a resonance tube containing H_2O, EtOH, or $COMe_2$ is illustrated and discussed. These resonances are characteristic of the liquid used. A. J. E. W.

Measurement of the velocity of sound in liquids by ultrasonic surface interferences. J. P. CANCE (Compt. rend., 1938, **206**, 504—505).—Wave trains from two piezo-electric crystals immersed in the liquid are made to interfere in the surface, causing visible stationary waves; measurement of these enables the velocity of sound (v) to be deduced. v for PhMe is 1325 m. per sec. A. J. E. W.

Longitudinal waves of very high frequencies in viscous fluids. R. LUCAS (Compt. rend., 1938, **206**, 658—659).—Expressions are derived for the limiting vals. towards which the velocity of propagation and the decrement tend as the frequency is increased. A. J. E. W.

Atomic heats of tin in the superconductive and in the non-superconductive state. W. H. KEESOM and P. H. VAN LAER (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 96).—The difference between the at. heats of Sn in the superconducting and non-superconducting states is in accord with the val. calc. from the formula $\Delta C = VT.\mathrm{d}^2/\mathrm{d}T^2(H_k^2/8\pi)$. Satisfactory accord was also obtained with the formula $\Delta S = V.\mathrm{d}/\mathrm{d}T(H_k^2/8\pi)$. The at. heats in the superconductive state follow nearly a T^3 law, whilst for the non-superconductive state at $<3{\cdot}2°$ K. they can be represented by a Debye T^3 term ($\theta_D = 185$) and a γT term which can be ascribed to free electrons. The experimental val. for γ is $>$ the val. calc. on the assumption that the no. of free electrons per atom is equal to the valency. J. W. S.

Exact measurement of specific heat of metals at high temperatures. XXIX. Specific heats, electrical resistance, thermoelectrical behaviour, and thermal expansion of neodymium in connexion with its allotropic changes. F. M. JAEGER, J. A. BOTTEMA, and E. ROSENBOHM (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 120—138; cf. A., 1937, I, 405).—These properties have been measured over various temp. ranges between 100° and 760°. At least four allotropic forms exist, transition points occurring at −164°, 508°, and 714°. The changes near the two last temp. are accompanied by hysteresis phenomena, doubtless caused by the slow re-establishment of dynamic equilibrium between the different forms of the metal in the successive phases. Nd which has been heated to >740° expands during cooling to 640°, and then obtains a permanent elongation which has an accumulative character every time the thermal cycle is repeated. J. W. S.

Exact measurement of specific heat of metals at high temperatures. XXX. Specific heats of pure iron between 25° and 1500°. A. J. ZUITHOFF (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 264—274).—Vals. of the mean and true (C_p) sp. heats are recorded; between 250° and 600° $C_p = 0{\cdot}1335 + (1{\cdot}5406 \times 10^{-5})(\theta - 250) + (5{\cdot}289 \times 10^{-7})(\theta - 250)^2 - (6{\cdot}51 \times 10^{-10})(\theta - 250)^3$. Freshly prepared Fe contained H_2, N_2, and traces of O_2, and gave anomalous results, particularly between 100° and 760°; the gases were removed by repeated heating to 950°. A discontinuity in the C_p–θ curve occurs at 130—190°, but no change of structure is observed at this temp. The Curie point of pure Fe is 760°. A. J. E. W.

Calculation of molecular heats of liquids. P. GUARESCHI (Atti R. Accad. Lincei, 1937, [vi], **26**, 403—405; cf. A., 1938, I, 233).—The relationship found previously leads to the following expression for the mol. heat, C, of a liquid, viz., $C = (\pi/3)\alpha n(N/J)q^2(\mathrm{d}\gamma/\mathrm{d}T)$, where n = no. of atoms in the mol., α = coeff. of association of the liquid, N = Avogrado's no., J = mechanical equiv. of heat. Approx. agreement with the experimental vals. is obtained. O. J. W.

Critical temperatures of liquids. L. SIBAIYA (Current Sci., 1938, **6**, 329—330).—Experimental vals. for 8 common liquids are compared with those obtained from the formula crit. temp. (°c.) = 3/(10 × coeff. of expansion at 0°). L. S. T.

M.p. of silicon. F. HOFFMANN and A. SCHULZE (Metallwirts., 1938, **17**, 3—6).—The m.p. of pure Si (99·89%) is 1410°±2°, and that of commercial Si (98%) about 2° lower, determined by thermo-electric and optical pyrometer measurements. C. E. H.

Transition [temperatures] of some deuterammonium salts. K. CLUSIUS, A. KRUIS, and W. SCHANZER (Z. anorg. Chem., 1938, **236**, 24—36).—The transition temp. of some ND_4 salts have been determined and those of the corresponding NH_4 salts redetermined, as follows: NH_4CNS, 90°; ND_4CNS 84°; $(NH_4)_2SO_4$ −48·5°; $(ND_4)_2SO_4$ −48·1°; NH_4NO_3 II → I 123·5°, III → II 84·0°, IV → II 52°, V → IV −12°; ND_4NO_3 II → I 123·5°, IV → II 50°, V → IV 0°; NH_4Cl II → I 184°, III → II −30·3°; ND_4Cl II → I 175°, III → II −23·7°; NH_4Br II → I 141°, III → II −38·8°; ND_4Br II → I 132°, III → II −58·5°. ND_4Br has a third transition point at −104°; this could not be observed for NH_4Br. The effect of substituting D for H can be correlated with

the smaller radius of the ND_4^+ ion in the simpler cases. F. J. G.

Thermal transition in solid deuteroammonium sulphate, $(NH_4)_2SO_4$. I. NITTA and K. SUENAGA (Bull. Chem. Soc. Japan, 1938, **13**, 36—41).—Dilatometric and sp. heat measurements and thermal analysis indicate that the transition points of $(NH_4)_2SO_4$ and $(ND_4)_2SO_4$ are −50° and −49·5°, respectively. The heats of transition are 210 and 225 g.-cal per g.-mol., respectively. J. W. S.

Specific volume of steam in the saturated and superheated condition together with derived values of the enthalpy, entropy, heat capacity, and Joule-Thomson coefficients. IV. Steam research programme. F. G. KEYES, L. B. SMITH, and H. T. GERRY (Proc. Amer. Acad. Arts Sci., 1936, **70**, 319—364; cf. A., 1934, 952).—Data are recorded. CH. ABS. (*e*)

Normal density and limiting density of oxygen. Density of ammonia. E. MOLES and C. ROQUERO (Anal. Fís. Quím., 1937, **35**, 263—268).—O_2 from $KMnO_4$ by pyrolysis in a new apparatus (cf. A., 1937, I, 338) has d 1·427604 + 0·001347$_5p$ between 253 and 760 mm.; coeff. of compressibility 0·000929; deviation from Avogadro's law 1·00093, in agreement with previous work; whence it is calc. that R is 0·082047. d for synthetic NH_3 measured in the same apparatus was in agreement with the val. previously obtained (*loc. cit.*). F. R. G.

Limiting density of silicon tetrafluoride. At. wt. of fluorine. E. MOLES and T. TORAL (Z. anorg. Chem., 1938, **236**, 225—231).—The limiting density of SiF_4 has been determined by the classical method. The mol. wt. is 104·085. With the international val. (28·063) for Si this gives F = 19·005, but the most probable vals. are Si = 28·104 and F = 18·995. F. J. G.

Variation of physical constants in homologous series. II. Density. V. G. ARANDA (Anal. Fís. Quím., 1937, **35**, 186—205).—Vals. given by the formula $d_4^{20} = 1/(1·167 + b/M)$ previously (A., 1936, 1090) proposed for hydrocarbons are compared with experimental vals., which are tabulated, for other classes of compounds each having its own b. Divergencies may be due to experimental errors, to the first member of each series, and to association in the lower members of alcohols, acids, and their derivatives. F. R. G.

Simultaneous measurements of density and surface tension. L. E. DODD (Physical Rev., 1936, [ii], **50**, 387).—Further measurements (A., 1937, I, 202) of increased precision have been made on 10 alcohols. L. S. T.

Thermodynamic properties of helium at high pressure. W. JACYNA (J. Amer. Chem. Soc., 1938, **60**, 555—558).—Published v.p. data are tabulated. The "vol.-work," sp. vol., vol. deviation, expansion coeff., sp. heats, Joule effect, and Joule-Thomson effect are computed for the range −70° to 200° and 103·3—30,000 kg. per sq. cm. E. S. H.

Thermal properties of halides. XI. Phosphorus pentachloride and aluminium phosphorus chloride $AlPCl_8$. W. FISCHER and O. JÜBERMANN (Z. anorg. Chem., 1938, **235**, 337—351).—Some physical properties of PCl_5 have been redetermined. The vals. for the v.d. agree with the equation given by Nernst (A., 1916, ii, 418); the v.p. between 100·5° and 158·1° is given by $\log p = -16{,}100/4·57T + 11·034$; vals. in the upper part of the range are ≫ those of Smith and Calvert (A., 1914, ii, 628). ρ for the liquid is $\rho_4^t = 1·599 - 0·0019(t - 160)$. From the results the following have been computed: heat of sublimation (to undissociated vapour) = 15·5 kg.-cal. per g.-mol., heat of dissociation (at approx. 200°) = 22 kg.-cal. per g.-mol. The results are discussed in connexion with the classification of halides. The m.p. curve for the system $AlCl_3$–PCl_5 has been determined and the existence and stability of the compound $AlPCl_8$ confirmed. V.d. measurements show that in the vapour it is largely but not completely dissociated. Its m.p. is 380° and its low volatility indicates an ionic structure. F. J. G.

[Physical properties of] cyanogen chloride. A. KLEMENC and G. WAGNER (Z. anorg. Chem., 1938, **235**, 427—430).—The v.p. of CNCl between −12° and 14° has been determined. The b.p. is 13·0°, the m.p. −6·5° and the triple point is at 337 mm. and −6·3°. The v.d. corresponds with a mol. wt. of 62·9 and ρ for the liquid is 1·247 at 0°. F. J. G.

Vapour pressure of liquid cyanic acid. M. LINHARD (Z. anorg. Chem., 1938, **236**, 200—208).—The v.p. has been measured between −76° and −6°, and is given by $\log p = -1735·32/T + 1·75 \log T - 0·0050499T + 5·90063$. The b.p. is 23·5°, the heat of vaporisation is 6·72 to 6·93 kg.-cal., and the Trouton coeff. is 22·6 to 23·5. HCNO is an abnormal liquid. F. J. G.

Proof of the equality at the absolute zero of work and total heat independently of the third law of thermodynamics. M. DI JORIO (Nuovo Cim., 1937, **14**, 480—485).—Theoretical. O. J. W.

Additivity of the van der Waals constant a. N. BARBULESCU (J. Chim. phys., 1938, **35**, 27—32).—Theoretical. E. S. H.

Thermodynamic properties of hydrocarbons. W. C. EDMISTER (Ind. Eng. Chem., 1938, **30**, 352—358).—Theoretical. A reduced equation of state is derived, viz., $V/\alpha_c = (RT_cT_r/P_c\alpha_cP_r) - \alpha_r$, where suffixes c and r refer to crit. and reduced vals., respectively, and α is the difference between the actual and ideal gas vol. The ratio $RT_c/P_c\alpha_c$ is practically const. Using the reduced equation, the effect of pressure on vapour fugacity, C_p, S, H, and $C_p - C_v$ has been calc. A new equation for C_p at 1 atm. has also been derived, viz., $C_p = 2·56 + 0·51n + (0·0013n^2 + 0·0044n - 0·00065mn + 0·00495m - 0·0057)T$, where n and m are the no. of C and H atoms, respectively. The equations are discussed with reference to published data. C. R. H.

***X*-Ray measurement of the thermal expansion of magnesium.** J. D. HANAWALT and L. K. FREVEL (Z. Krist., 1937, **98**, 84—88; cf. A., 1935, 918; 1936, 785).—By back-reflexion from the (114) and (105) planes in the range 36—233°, the mean

principal linear expansion coeffs. (α_a, α_c) are respectively 2·77, 2·93 × 10^{-5}. I. McA.

Accommodation coefficient and molar heat of various hydrocarbon molecules. O. Beeck (Physical Rev., 1936, [ii], **50**, 387).—The coeff. α as defined by $T_1 - T_2 = \alpha(T_1 - T)$ where T, T_1, and T_2 are the mean temp. of the surface and of the gas mols. before and after collision, respectively, has been measured for normal hydrocarbons up to C_8, and for a no. of unsaturated hydrocarbons on a Ni surface at 140°, by the mol. beam method at approx. 10^{-5} mm. pressure. For the paraffins $\alpha(C_{v_e} + R/2) = c_1 M$, which gives $\alpha = c_1 M/(c_2 M + c_3 + R/2)$, where c_1, c_2, and c_3 are experimental consts. L. S. T.

Compressibility of liquid naphthalene. F. R. Russel and H. C. Hottel (Ind. Eng. Chem., 1938, **30**, 343—345).—The d of liquid $C_{10}H_8$ at temp. $>474°$ has been determined at const. pressure (3030 and 5800 lb. per sq. in.), and, with the aid of data from the International Critical Tables, compressibility factors have been calc. for various temp. and pressure ranges. C. R. H.

Free draining of liquids in capillary tubes A. Grumbach (J. Phys. Radium, 1938, [vii], **9**, 49—51).—Mathematical. Discussion of possible errors in viscosity tube measurements. W. R. A.

Rate of viscous flow of metals. I. Tin. L. C. Tyte (Proc. Physical Soc., 1938, **50**, 153—175).—A new method is described, measurements being made by means of an optical lever system, for determining the dependence of rate of viscous flow of metals on the deforming force and its variation with temp. Experiments on Sn from room temp. to the m.p. and over a wide load range show that, for very small extensions, the velocity of viscous flow is independent of time and is an exponential function of the stretching load for a given temp. and of the abs. temp. for a given load. Relationships are deduced and full data are tabulated and plotted. There is evidence that the temp. of the allotropic β–γ change is 203° and not 161°. The loads for transition from single to double glide and the breaking loads are connected hyperbolically with the corresponding temp. The behaviour of Sn wire is in general agreement with results for single crystals. N. M. B.

Viscosity curve of aniline. L. Steiner (Chem. Obzor, 1937, **12**, 210—212).—The viscosity curve for chemically pure NH_2Ph between 20° and 100° has been determined with an average abs. accuracy of ±0·2%. NH_2Ph is considered a good comparison liquid, especially for higher temp. F. R.

Equilibrium isotherms and isobars of mixtures of carbon monoxide, nitrogen, and water. V. Fischer (Ann. Physik, 1938, [v], **31**, 531—539; cf. A., 1935, 167).—Using the vals. of Verschoyle (A., 1931, 1370) the isotherms at −185° and −205°, and the isobars at 150 and 30 atm. have been described. O. D. S.

Hydrogen–nitrogen–carbon monoxide system and the carbon monoxide "wash." M. Ruhemann and N. Zinn (Physikal. Z. Sovietunion, 1937, **12**, 389—403).—Isotherms and isobars relative to the binary systems H_2–CO and H_2–N_2 and the ternary system H_2–N_2–CO are recorded for 90°, 83°, and 78° K. and the pressure range 12—50 atm. The results are used to determine the optimum conditions for the industrial removal of CO from coal gas. I. McA.

Compressibility of butane–pentane mixtures below one atmosphere. F. W. Jessen and J. H. Lightfoot (Ind. Eng. Chem., 1938, **30**, 312—314).—The compressibility, C, of n-C_4H_{10}–n-C_5H_{12} mixtures at 30° and at pressures >500 mm. Hg increases linearly with increasing $[C_5H_{12}]$. The C of C_3H_8 at 0° and 50° and of *iso*-C_4H_{10} at 0° and 30° have also been determined. The observed vals. of the C coeff. variation with temp. are < those calc. from the relation of Cawood and Patterson (cf. A., 1933, 770). C. R. H.

Physico-chemical studies of dioxan–water mixtures. L. W. Öholm (Finska Kem. Medd., 1938, **67**, 19—38).—Measurements of d, η, n_D, and Δ have been made at 20°. For solutions of electrolytes Δ, α, and κ decrease rapidly with increasing dioxan concn. M. H. M. A.

Correlation of fluidity curves with f.-p. curves in binary systems. R. H. Ewell (J. Chem. Physics, 1937, **5**, 967—973).—Binary systems which form cryst. compounds usually show negative deviation from the ideal laws of solutions and the deviations are often parabolic functions of the mol. composition with max. at approx. 50 mol.-%. Since fluidity always shows this type of deviation irrespective of the composition of any cryst. compound or compounds formed, there can be no correlation between the max. of the fluidity deviation and the composition of the cryst. compound. The bearing of this conclusion on the formation of compounds in the liquid is discussed. W. R. A.

Heat of mixing of liquids. V. Heat of mixing of benzene with dichloroethane, benzene with carbon tetrachloride, and hexane with heptane. V. A. Kireev, V. T. Bikov, and V. V. Chodortschenko (J. Phys. Chem. Russ., 1937, **10**, 807—812).—The heats of mixing referred to 1 mol. of the mixture are max. at 0·7 mol. $(CH_2Cl)_2$, 0·5 mol. CCl_4, and 0·5 mol. C_6H_{14}. They are small and positive for the last system but negative for the others. J. J. B.

Relation between simple distillation and true b.-p. curves of complex mixtures the components of which obey Raoult's law. E. M. J. Pease (J. Math. Phys. Mass. Inst. Tech., 1938, **16**, 202—214).—Mathematical. E. S. H.

Liquid–vapour phase equilibrium relations in the ethane–*n*-heptane system. W. B. Kay (Ind. Eng. Chem., 1938, **30**, 459—465).—T–X diagrams for the co-existing liquid and vapour at const. pressure compare satisfactorily with those calc. by the solution laws until pressures near the crit. pressure of n-C_7H_{16} are reached. J. W.

Intermetallic compounds. F. Weibke (Z. Elektrochem., 1938, **44**, 209—221, 263—282).—A review.

New type of structure in the α-copper–zinc alloys. F. N. Rhines and A. M. Montgomery

(Nature, 1938, **141**, 413).—A banded microstructure is produced at the junction of two Cu crystals into which Zn vapour has diffused. This is not due to twinning, but to the growth of long, parallel, finger-like bands from one crystal into the other.

L. S. T.

Electrolytic diffusion in solid metallic alloys. W. SEITH and T. DAUR (Z. Elektrochem., 1938, **44**, 256—260).—The electrolytic diffusion of N, B, C, and Si in Fe has been investigated under similar conditions. B and C move towards the cathode and N towards the anode with approx. the same velocities. Movement of Si could not be detected and specially sensitive methods failed to reveal diffusion of Ni in Fe.

T. H. G.

Rates of diffusion in the α-solid solutions of copper. F. N. RHINES and R. F. MEHL (Amer. Inst. Min. Met. Eng., Tech. Publ. 883, Jan., 1938, 37 pp.; Met. Tech., 1938, **5**, No. 1).—Diffusion coeffs. have been determined from concn.-penetration curves by the Matano method for Cu–Zn, Cu–Al, Cu–Be, Cu–Cd, Cu–Si, and Cu–Sn. The diffusion rate increases with increasing concn. of solute at first slowly and then with increasing rapidity as the solid solubility limit is approached. The temp. coeff. of the diffusion rate is calc. and used to obtain the activation heat of diffusion.

R. B. C.

Factors influencing stability of superlattices. R. HULTGREN and L. TARNOPOL (Nature, 1938, **141**, 473—474).—Substitution of Ag for Au in Au–Cu alloys decreases the temp. of transformation from the "ordered" state, in which 1 Au is surrounded by 8 Cu and 4 Au, to the "disordered state," in which 1 Au has an average of 6 Au and 6 Cu neighbours. The results of these experiments, which were carried out in order to determine the "energy of ordering" due to interaction between neighbouring atoms as distinct from that due to geometrical strain, agree with predictions.

L. S. T.

Compressibilities and electric resistance under pressure, with special reference to intermetallic compounds. P. W. BRIDGMAN (Proc. Amer. Acad. Arts Sci., 1935, **70**, 285—317; cf. A., 1935, 567).—Data for compressibilities and changes in resistance under pressure up to 12,000 kg. per sq. cm. at 30° and 75° are recorded for Ag_5Cd_8, Ag_5Zn_8, Cu_5Cd_8, $Cu_{31}Sn_8$, CuZn, AgCd, AuZn, AgZn, Cu_3Sn, Ag_2Al, Mg_3Al_2, Mg_xAl_y, Mg_2Pb, $MgZn_2$, SbSn, $AuSb_2$, Sb_2Tl_7, Ge, LiF, Ag_2S, PbSe, PbTe, $Ag_2SO_4,4NH_3$, and basalt glass. Data for Al, Cu, Co, Ca, Ge, Au, Pb, Mo, nichrome, Ni, Pd, Pt, Ag, Sr, Ta, and U are corr. Compressibilities calc. from at. vols. and *X*-ray parameters are > observed vals. Vals. of the sp. resistance are > those calc. from the rule of mixtures. The pressure coeff. of resistance is negative, as for most pure metals, but is numerically smaller. Tetragonal $Ag_2SO_4,4NH_3$ crumbles and assumes a milky appearance after compression to 1000 kg. per sq. cm. Artificial basalt has been studied at 0°, 30°, 50°, 75°, and 95°. CH. ABS. (*e*)

Galvano-magnetic effects in bismuth alloys. N. THOMPSON (Proc. Roy. Soc., 1938, **A**, **164**, 24—47).—The magneto-resistance and Hall effects are measured for Bi with small % of Pb and Se as impurities between 20° and 290° K. The measurements of the magneto-resistance effect agree with theory for high fields, low temp., and very small % of impurities. At low fields and higher impurity content discrepancies occur, for which an explanation is advanced. The no. of free electrons per atom is computed and found to be of the order 10^{-5}.

G. D. P.

***X*-Ray investigations of the binary systems TiO_2–MgO, ZrO_2–MgO, ZrO_2–TiO_2.** W. BÜSSEM, C. SCHUSTERIUS, and A. UNGEWISS (Ber. Deut. Keram. Ges., 1937, **18**, 433—443).—The mixtures, pressed and calcined at cone 16, were examined by the Debye–Scherrer powder method. The compounds $2MgO,TiO_2$, MgO,TiO_2, and $MgO,2TiO_2$ were identified in the MgO–TiO_2 system but the TiO_2–ZrO_2 system is a simple eutectic type. The ZrO_2–MgO system shows a very small range of mixed crystals with a compound $2MgO,3ZrO_2$. The *X*-ray information is correlated with the ceramic properties of certain mixtures. It is suggested that the effect of ZrO_2 in improving the power factor of TiO_2 dielectrics is due to the inhibition of the reaction $TiO_2 \rightarrow Ti_2O_3$, the latter oxide being a partial electrical conductor.

J. A. S.

New kinds of mixed crystals. IV. H. G. GRIMM, C. PETERS, and H. WOLFF (Z. anorg. Chem., 1938, **236**, 57—77).—Mixed crystal formation in systems typified by $BaSO_4$–$KMnO_4$ has been investigated. For the system $BaSO_4$–$KMnO_4$, $[KMnO_4]$ in the crystals increases steadily with $[KMnO_4]$ in the solution (although they are not strictly proportional); it decreases with rising temp. and as the amount of ppt. increases. When K^+ is replaced by other univalent cations the occlusion for a given concn. decreases in the order K, Rb, NH_4, Na, Li, Cs. If abs. concn. be replaced by relative concn. (% of solubility) the order becomes K, NH_4, Na, Li, Rb, Cs. The system $BaSO_4$–$Ba(MnO_4)_2$ exhibits abnormal mixed crystal formation. The behaviour of $BaSeO_4$ and $BaCrO_4$ towards $KMnO_4$ closely resembles that of $BaSO_4$ but $SrSO_4$ and $SrCrO_4$ do not form mixed crystals with $KMnO_4$. $KMnO_4$ also forms mixed crystals to a small extent with $KHSO_4$ and with KBF_4. $BaSO_4$ forms mixed crystals with $BaMnO_4$ and $BaFeO_4$, and these substances are stabilised by the occlusion. $BaSeO_4$, but not $BaTeO_4$, forms mixed crystals with $BaMnO_4$. The results are discussed in terms of crystal structure and lattice distances.

F. J. G.

Determination of reciprocal solubilities of water and an organic liquid by pyknometer and refractometer. A. NIINI (Suomen Kem., 1938, **11**, **A**, 19—20).—A relation connecting d and n for binary liquid mixtures has been used to determine the reciprocal solubilities of H_2O and a no. of org. liquids. The calc. and observed vals. are in good agreement.

M. H. M. A.

Solubility of phenols in formalin. N. J. L. MEGSON (Trans. Faraday Soc., 1938, **34**, 525—532).—Mutual solubilities of *m*-5-xylenol and H_2O up to 98°, and of PhOH, *m*-cresol, and *m*-5-xylenol respectively with MeOH–H_2O mixtures at 0°, 25°, and 50° have been determined. The solubility of

m-cresol in formalin cannot be due to the MeOH contained in the latter, and is probably to be attributed to immediate chemical action at room temp. F. L. U.

Influence of salts on the solubility of water in phenol. IV. R. CERNĂTESCU and E. PAPAFIL (Ann. Sci. Univ. Jassy, 1938, **24**, 163—195; cf. A., 1928, 579).—For alkaline-earth salts of concn. c the influence on the solubility of H_2O in PhOH S_0 is given by $K = (S_0 - S)/c$, where S is the solubility of H_2O in PhOH in presence of the salt. K is a sp. const. for each salt, and for alkali or alkaline-earth salts increases in the order I, Br, Cl; for cations K decreases in the order Li, Na, K, Rb, NH_4, Co, and Mg, Sr, Ba. For Mg, Sr, and Ba salts, K passes through a min. at 0·002—0·005N. The influence of temp. has been investigated. E. S. H.

Confining liquids for gas analysis. Solubility of common gases in acid sodium sulphate solution. K. A. KOBE and F. H. KENTON (Ind. Eng. Chem. [Anal.], 1938, **10**, 76—77; cf. B., 1935, 258).—Data for the solubility at 25° and 760 mm. are recorded for SO_2, CO_2, N_2O, C_2H_2, C_2H_4, CH_4, C_2H_6, H_2, CO, O_2, and N_2 and for certain mixtures with air, in a solution containing 200 g. of Na_2SO_4, 40 ml. of 36N-H_2SO_4, and 800 g. of H_2O. This solution cannot be used as a confining liquid at temp. $< 16°$ without danger of pptn. L. S. T.

Solubility of sodium fluoride in sodium carbonate, sodium hydrogen carbonate, and their mixtures. G. V. SOKOLOVA (Trans. Inst. Fert. Insectofung. U.S.S.R., 1935, **123**, 176—179).—Data are tabulated. CH. ABS. (*e*)

Dissolution of solid water-glass in water. W. J. MÜLLER, W. MACHU and W. STIDL (Z. anorg. Chem., 1938, **236**, 232—242).—The dissolution of an acid water-glass in H_2O proceeds more rapidly and at a lower temp. when it is present in large excess, and the solution then has the same composition as the solid. In this way solutions containing up to 60% can be obtained. At a given concn., the solutions obtained at 100° in this way have lower η than those obtained in the ordinary way at 150—170°. F. J. G.

Crystal growth from solutions. W. F. BERG (Proc. Roy. Soc., 1938, **A**, **164**, 79—95).—An interference method is described by means of which the concn. of the solution surrounding a growing crystal of $NaClO_3$ is measured. The observations show that the concn. is not const. over a crystal face, but that it is highest at the corners. There is an adsorbed layer, in which lateral flow of mols. takes place, on the surface of the crystal. This layer is regarded as a transition between the solid and liquid states and appears to play an important part in the mechanism of crystal growth. The results indicate the existence of a new effect which makes the mols. in the solution and in the adsorbed layer react differently at the corners and at the centres of the faces. G. D. P.

Phase equilibria in systems involving hydrochloric and sulphuric acids. II. Distribution of hydrogen chloride between sulphuric acid solutions and benzene. G. P. LUTSCHINSKI and A. I. LICHATSCHEVA (J. Phys. Chem. Russ., 1937, **10**, 822—830).—C_6H_6 saturated with H_2O dissolves at 20°/760 mm. 16·35 g. per l. of HCl. The distribution coeff. H_2O/C_6H_6 rapidly decreases with increasing [HCl] and there are two singular points at 13·2 and 34·2% HCl in H_2O. For $[H_2SO_4] > 50$ wt.-% the distribution coeff. decreases with increasing [HCl]; for $[H_2SO_4] < 50\%$ it first increases and then decreases. J. J. B.

Permeability of the lattices of metals by hydrogen. M. WIDEMANN (Metallwirts., 1937, **16**, 1367—1369).—It is considered unlikely that H_2 is able to penetrate the lattice of a metal, but it may diffuse along grain boundaries, pores, and cracks. The different degrees of permeability of metals may be connected with their ability to favour the formation of at. H. C. E. H.

Surface tension and wetting. G. BAKKER (Chem. Weekblad, 1938, **35**, 159—165).—The kinetic theory of fluids is reviewed with special reference to surface phenomena. D. R. D.

Adsorption of helium on charcoal below 78° K., and production and thermometry of low temperatures. E. KANDA (Bull. Chem. Soc. Japan, 1938, **13**, 241—246).—The adsorption of He on charcoal has been studied at 13—78° K. The heat of adsorption, determined by an evaporation method, is 1·2 kg.-cal. per g.-mol., a val. $\ll$ that found by Dewar (A., 1904, ii, 652) or that calc. from the adsorption isotherms. Attempts have been made to attain low temp. by rapid desorption of He, and, starting with He at 14·9° K., a final temp. of 5·8° K. was attained. A modified form of He thermomcter is described; it has been used to calibrate constantan and manganin resistance thermometers down to 6° K. J. W. S.

Activated adsorption of gases by vitreous materials. Consequences of removal of gases from glass surfaces. M. PRETTRE (Docum. sci., 1935, **4**, 241—249).—A review. In degassing a glass surface it is important not to reach the temp. at which activated adsorption commences. Temp. corresponding with the min. of the isobars are preferable. CH. ABS. (*e*)

Chemistry of adsorptive binding. H. KAUTSKY and F. GREIFF (Z. anorg. Chem., 1938, **236**, 124—137).—The adsorption isotherms for CH_4, C_2H_6, and C_3H_8 on $Si_6H_6O_3$, $Si_6H_5O_3Br$, and $Si_6H_3O_3Br_3$ have been determined. For a given adsorbent the adsorption increases in the order CH_4, C_2H_6, C_3H_8. The adsorption by $Si_6H_6O_3$ follows the simple mass-action law, and the saturation vals. depend on the size and form of the adsorbed mols. Replacement of H by Br leads to a departure from the simple law since there is now more than one kind of adsorptive centre. F. J. G.

Adsorption of ions which do not determine the potential on sparingly soluble salts as solid phases. A. KELLERMANN and E. LANGE (Z. anorg. Chem., 1938, **236**, 138—156).—Theoretical. A thermodynamical equation is deduced and used to correlate observed results for the adsorption of Th-*B*″ by sparingly sol. salts. F. J. G.

Adsorption of electrolytes on silver iodide. I. R. PROTAS (J. Phys. Chem. Russ., 1937, **10**, 844—847).—The adsorption of I′ from KI solution by AgI powder increases when KNO_3, $Ba(NO_3)_2$, $Al(NO_3)_3$, or $Th(NO_3)_4$ is added to the solution. J. J. B.

Adsorption of ions of water by precipitates. IV. System $Pb^{\cdot\cdot} + SO_4^{\prime\prime}$. I. TANANAEV and N. I. MIRIANASCHVILI (J. Appl. Chem. Russ., 1938, **11**, 126—130).—Adsorption of $H^{\cdot}$ by $PbSO_4$ occurs only in presence of K, and is at a max. for the salt $PbSO_4,K_2SO_4$. R. T.

Recharging of active charcoal in an oxygen atmosphere. N. A. BACH and A. V. ZIMIN (J. Phys. Chem. Russ., 1937, **10**, 761—765).—Cataphoretic observations are recorded. Charcoal heated at 900° in H_2 is positive in H_2O and becomes more positive if treated with O_2. In presence of O_2, but not in presence of H_2, the charcoal is made negative by NaOH. J. J. B.

Sugar charcoal. I. Grain structure of sugar charcoal. II. Sugar charcoal as irreversible colloid. B. L. VANZETTI (Rend. sem. fac. sci. Cagliari, 1933, **3**, 141—142, 142—144).—I. Grain structure of charcoal produced by the action of H_2SO_4 on carbohydrates is detectable ultramicroscopically after progressive replacement of H_2O by EtOH, PhMe, and paraffin.

II. After dehydration in vac. at 120° only 7·7% of the original H_2O is taken up again.

CH. ABS. (*e*)

Lyotropic series. I. Adsorption of salts on methylcellulose. E. HEYMANN, H. G. BLEAKLEY, and A. R. DOCKING (J. Physical Chem., 1938, **42**, 353—368; cf. A., 1936, 427).—The apparent adsorption of KCNS on methylcellulose (I) at 59° is positive, for KI zero, and for the other salts studied increasingly negative in the order: KBr, KOAc, KNO_3, KCl, K_2SO_4. From the results with K_2SO_4 the min. hydration of (I) is calc. to be 0·25 g. H_2O per g. The solubility of (I) in H_2O is increased by KCNS and KI (the true adsorption of which is considerable) and decreased by the other salts. The results are in accord with Katz's theory (A., 1933, 462).

F. L. U.

Alkali absorption by synthetic resins. E. I. AKEROYD and G. BROUGHTON (J. Physical Chem. 1938, **42**, 343—352).—Phenol- (I), pyrocatechol- (II), resorcinol- (III), quinol-, and phloroglucinol- (IV) CH_2O resins of the insol. cross-linked type absorb NaOH, $Ca(OH)_2$, $Ba(OH)_2$, and $CH_2Ph{\cdot}NMe_3{\cdot}OH$, but not $CaSO_4$. Admixture with an equal wt. of kieselguhr scarcely affects the absorption per g. of resin. Absorption of the metal hydroxides by (I), (II), and (III) approaches the max. calc. on the assumption of chemical combination with the free OH groups. (IV) shows a lower absorption than (II) or (III), the deficiency being more marked when NH_3 is used instead of acid as a catalyst. The effect is attributed to steric hindrance. The equilibrium absorption decreases with increase in the size of the cation. The results can be adequately explained on the basis of chemical action, the rate of absorption being determined by the accessibility of the internal OH groups. F. L. U.

Effect of surface forces on melting. W. A. PATRICK and W. A. KEMPER (J. Physical Chem., 1938, **42**, 381—390).—An equation is derived for the melting temp. of substances condensed in porous adsorbents. The calc. temp. are lower than those which correspond with max. heat capacity, the difference probably being due to hysteresis. An expression is also obtained for the apparent heat capacity of an adsorbed phase, and the calc. vals. are compared with those observed for the substances previously studied (cf. A., 1938, I, 248). F. L. U.

Behaviour of liquid drops and adsorbed films at cleavage surfaces of mica. D. H. BANGHAM and Z. SAWERIS (Trans. Faraday Soc., 1938, **34**, 554—570; cf. A., 1938, I, 27).—The experiments described lead to a classification of a no. of pure liquids in respect of their ability or inability to spread on fresh cleavage surfaces of mica, of the influence of adsorbed vapour on the contact angle, and of their behaviour in presence of a second liquid. The films formed by org. vapours are multimol. except at low pressures, and can be built up to a thickness showing interference colours without exhibiting the physical properties of the bulk liquids; *e.g.*, they give a finite contact angle with a drop of their own liquid, and movement over them does not take place by ordinary viscous flow. F. L. U.

Mechanical properties (viscosity, rigidity, and strength) of adsorption layers and their relation to the area per molecule and to the nature of the underlying liquid. A. A. TRAPEZNIKOV and P. REHBINDER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 185—189).—Measurement of the period of oscillation of a disc suspended by a torsion wire in a monolayer of a surface-active, H_2O-insol. substance affords a quant. method for the study of the relation between the mechanical properties of the films and the area per mol. The surface viscosity or strength of adsorption layers increases with the surface concn. and reaches a max. on complete saturation. The resistance to shear increases continuously as the film is compressed and shows a very sharp rise on transition to the condensed state. On pure H_2O palmitic acid remains viscous up to the saturation point, whilst the presence of multivalent cations results in the formation of elastic films with a tensile strength of 10—11 dynes per cm. Acidification of the underlying liquid, however, gradually transforms the film from the elastic state through a plastic region into the viscous state, whilst, for a const. p_H val., an increase in cation concn. involves the solidification of the film. An increase in the length of the hydrocarbon chain in homologous series results in a gradual enhancement of the resistance to shear on transition from viscous to plastic and, finally, to elastic films.

W. R. A.

Directional distribution of water vapour leaving a capillary. P. RENAUD and G. COSTEANU (Compt. rend., 1938, **206**, 500—502).—The angular distribution of H_2O mols. issuing from a capillary into a vac. has been studied by condensing the H_2O on to a surface cooled in liquid air, and observing the thin-film interference fringes of the condensed H_2O layer. An optimum length of jet (3 cm. of

0·5 mm. capillary in this case) is found to give the narrowest beam of H_2O mols. A. J. E. W.

Surface-bound versus capillary-condensed water in wood. A. J. Stamm and L. A. Hansen (J. Physical Chem., 1938, **42**, 209—214).—H_2O is selectively adsorbed by wood from aq. sucrose, glycerol, and NaCl. When the lowering of the relative v.p. is >25%, a const. val. of 3% is approached, which is considered to represent the adsorption val. free from capillary condensation and non-equilibrium effects. The difference from the calc. val. (6%) is attributed to the surface-bound H_2O acting as a partial solvent. F. L. U.

Interlamellar swelling of vacuum-sublimed calcium fluoride layers by means of adsorbed cæsium. C. J. Dippel and J. H. de Boer (Rec. trav. chim., 1938, **57**, 277—290).—The adsorption of Cs by vac.-sublimed layers of CaF_2 is unaltered by sintering the CaF_2 at 350° for some hr., but is decreased after sintering for several hr. at 450°. The adsorption of I by the CaF_2 is greatly decreased by sintering at 350—450°. The sintered surface, after adsorption and desorption of Cs, adsorbs I to the same extent as the unsintered surface, owing to an interlamellar swelling of the CaF_2 induced by the Cs, and hence the sintered surface can be split up by the Cs to give its initial total area. The observations are not due to H_2O vapour. R. S. B.

So-called "transformation temperature" of metallic films. II. Effect of bake-out of the substratum. T. Fukuroi (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 333—343).—Effects of temp. change on resistance have been measured for thin films of Pb, Sb, Bi, Cd, and Zn condensed in high vac. on Pyrex surfaces previously baked out at 250°, 400°, and 500°. The results are compared with those obtained without baking (A., 1937, I, 358). Except for Sb, no rapid decrease of resistance at the "transformation temp." (previously called "transition temp.") is observed. Bake-out of the substratum has no effect on reflectivity of light. T. H. G.

Phoretic phenomena at the separation line of liquid phases. L. I. Belaev (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 1433—1452; cf. A., 1937, I, 461).—The phenomena of pseudo-extraction and phoresis at liquid–liquid boundaries (the ability of a film to move along the boundary under the influence of heat, mechanical, surface, and chemical factors) are described and discussed in relation to colloid phenomena and the corrosion of metals. The movement of Au film particles at a liquid–liquid boundary in an electric field has been studied; the rate is > that of ordinary electrophoresis. The influence of factors other than electrokinetic is discussed. E. S. H.

Study of passivity of iron using electron diffraction. T. Iimori (Bull. Chem. Soc. Japan, 1938, **13**, 152—158).—The transmissional electron diffraction pattern of the film isolated from Fe made passive with K_2CrO_4, and the reflexional pattern of Fe made passive with either HNO_3 or K_2CrO_4, indicate that the film is γ-Fe_2O_3 or Fe_3O_4, rather than α-Fe_2O_3. In view of the fact that Fe_3O_4 can be rendered passive by oxidising agents and other observations, it is concluded that the protective film is γ-Fe_2O_3. J. W. S.

Dielectric properties of aqueous solutions of salts. W. J. Dunning and W. J. Shutt (Trans. Faraday Soc., 1938, **34**, 467—479).—Dielectric consts. of solutions of KCl, K_2SO_4, $CaCl_2$, $MgSO_4$, $LaCl_3$, and $La_2(SO_4)_3$ (<0·02—0·06N) have been determined by a modification of the method described previously (A., 1937, I, 131) with a reproducibility of ±0·1%. The results can be expressed by $\epsilon_s - \epsilon_0 = A\sqrt{\gamma^*} - \epsilon_0 k\gamma^* + \epsilon_0 K\gamma^{*2}$, in which ϵ_s and ϵ_0 are the dielectric consts. of solutions and H_2O, A is the Debye–Falkenhagen const., γ^* is the equivalence of the solution, and k and K are related respectively to the Sack effect for saturation of solvent dipoles, and the desaturating effect in conc. solutions. F. R. G.

Dielectric constants of zwitterions and polar molecules as related to p_H. W. J. Dunning and W. J. Shutt (Trans. Faraday Soc., 1938, **34**, 479—485).—Since the dielectric const. (ϵ) of 1M-$CO(NH_2)_2$ is unaltered between p_H 2·0 and 11·5 it is inferred, contrary to Clow (A., 1937, I, 222), that $CO(NH_2)_2$ is not zwitterionic, but weakly basic with a high dipole moment. On the other hand ϵ of 0·2M-glycine solution falls when p_H is <4·5 or >7·0. The ionisation consts. of glycine are calc. from the ϵ–p_H curve by assuming that $\epsilon_s - \epsilon_0 \propto$ zwitterion concn., where ϵ_s and ϵ_0 are the dielectric consts. of the solution and H_2O. F. R. G.

Preparation, properties, and particle size determinations of mineral suspensions, with special reference to graphite. E. Hoffmann (Kolloid-Z., 1938, **82**, 351—362; **83**, 99—104).—A review.

Preparation of colloidal iodine solution. K. Shigena (Repts. Imp. Ind. Res. Inst., Osaka, 1935, **15**, No. 13, 1—31).—Colloidal I is obtained by Weimarn's method of mechanical dispersion at low temp. Stable colloidal I has been prepared by electrolysis of KI in presence of H_2SO_4 or by pouring an EtOH solution of I at −80° into H_2O with vigorous stirring. Ch. Abs. (e)

Preparation and purification of hydrous lanthanum hydroxide sols. T. Moeller and F. C. Krauskopf (J. Amer. Chem. Soc., 1938, **60**, 726—727).—Freshly-pptd. $La(OH)_3$ is readily peptised by $LaCl_3$ at 50°. The sol can be purified by dialysis against CO_2-free H_2O, but a trace of $LaCl_3$ appears to be necessary for stability. In the atm. the sols are converted into $La_2(CO_3)_3$. E. S. H.

Metallic couples. II. Preparation of alumina hydrosols. M. A. Miller (J. Physical Chem., 1938, **42**, 419—426; cf. A., 1937, I, 80).—An Al–Cu couple made by immersing Al sheet in alcoholic $CuCl_2$ for 1 min. gives rise to a stable $Al(OH)_3$ hydrosol when afterwards left in contact with H_2O. The sol is free from a detectable amount of stabilising ions. The couple prepared from aq. $CuCl_2$ gives a flocculent ppt. in H_2O and a hydrosol in dil. $AlCl_3$. Experiments on other Al couples are described. F. L. U.

Effect of salts on the acidity of vanadium pentoxide sols. M. M. Haring and W. J. Hart (J. Amer. Chem. Soc., 1938, **60**, 581—585).—Of

14 salts investigated, ten caused an initial decrease in acidity and nine produced a subsequent increase. The various factors contributing to these effects are discussed. E. S. H.

Cryolysis and particle size. V. Polyvinyl alcohol and silver sol. H. LEICHTER and F. F. NORD (Biochem. Z., 1938, **295**, 226—236; cf. A., 1937, I, 409).—Examination of the absorption spectra of solutions of polyvinyl alcohol and of colloidal Ag maintained for 3 hr. at −18° affords evidence of a close relation between colour, concn., and particle size. The fluorescence of Ag sol is destroyed, whilst the dispersity of 0·1% polyvinyl alcohol is increased, and that of 2% diminished, by freezing. F. L. U.

Mobility studies with colloidal silicic acid. F. HAZEL (J. Physical Chem., 1938, **42**, 409—414; cf. A., 1935, 821).—The mobility of SiO_2 sol (Graham) has been determined ultramicroscopically in presence of varying proportions of colloidal Al_2O_3 and Fe_2O_3. With both substances coagulation sets in before the mobility of the mixed system decreases appreciably. F. L. U.

Does a single constant suffice to represent the relation between viscosity and concentration of highly polymerised compounds? I. SAKURADA (Kolloid-Z., 1938, **82**, 345—350).—Consideration of experimental data for the η of solutions of cellulose esters, rubber, and synthetic polymerides leads to the conclusion that at least two consts. are required in the formula expressing the relation between η and concn., even for low concns. F. L. U.

Constitution and viscosity association of hydrocarbons of high mol. wt. B. YAMAGUCHI (Bull. Chem. Soc. Japan, 1938, **13**, 61—77).—η has been determined for various solutions of lubricating oils and polystyrenes in C_6H_6 at different temp. A linear relation exists between the temp. coeff. of η and the viscosity association of the oils. The effects of the lengths of the side-chains, of the branching of the chains, and of the existence and location of ring structures are discussed. J. W. S.

Influence of an electrolyte on the viscosity of an arsenic sulphide sol at different stages in its evolution. (MLLE.) S. THÉVENET (Compt. rend., 1938, **206**, 673—675; cf. A., 1938, I, 28).—The influence of small concns. (c) of KCl and $BaCl_2$ on η for As_2S_3 sols of different ages has been investigated. As c in a given sol increases, η decreases to a min. val. and subsequently increases, the min. val. never being < that reached by the pure sol on keeping. With sols of increasing age, the descending portion of the η–c curve becomes less pronounced, and in very old sols the min. val. disappears. With KCl the min. val. of η is independent of the age, but with $BaCl_2$ it decreases with age. A. J. E. W.

Variation of the internal friction of lyophilic colloids. III. Vaseline oil emulsions and their properties. C. ROSSI (Gazzetta, 1938, **68**, 3—20; cf. A., 1938, I, 193).—Measurements of η for emulsions of vaseline oil in 3% solutions of Na oleate in H_2O have been made, and the influence of the concn. of the disperse phase, of p_H, and of the velocity of rotation of the cylinder has been studied. The size of the particles has little effect on the val. of η_∞, but has a marked influence on the shape of the η curves. The results are discussed. O. J. W.

Colloid chemistry of system: soaps–cresol–water. III. Viscosity of solutions of mixed soaps in presence of *o*-, *m*-, and *p*-cresol. E. ANGELESCU and V. CIORTAN (Kolloid-Z., 1938, **82**, 304—311; cf. A., 1938, I, 193).—The η of mixtures of Na stearate (I) and Na palmitate (II) at a total concn. of 0·2N shows a max. at about 2% of cresol, and increases linearly with cresol concn. beyond 5—6%. The max. η decreases with increase of (II) concn. and with rise of temp., and vanishes when (II) concn./(I) concn. exceeds a certain val. The depression of the max. by (II) is influenced by cresols in the order o-<m-<p-. The effect is attributed to a dispersing action of (II) on (I). F. L. U.

Electrochemical nature of cellulose esters. (MME.) A. DOBRY (J. Chim. phys., 1938, **35**, 16—19).—The electrical conductivity of solutions of cellulose nitrates and acetates in $COMe_2$ increases with increasing degree of purification by dialysis, finally reaching a const. val. The limiting conductivity is small and ∝ concn. The mechanism of conduction in these systems is discussed. E. S. H.

Solubility of cellulose in water. J. STRACHAN (Nature, 1938, **141**, 332—333).—High-grade cellulose from wood or cotton is slightly sol. in pure H_2O at room temp. (1·4 to 2·1 parts per 10^5), forming a clear sol. This dispersion is probably accompanied by some breakdown in the cellulose mol. L. S. T.

Comparative electrochemical study of highly purified lyophilic sols. V. Dextrin and soluble starch. W. PAULI, jun., and S. SZPER (Kolloid-Z., 1938, **82**, 335—344; cf. A., 1937, I, 410).—Conductometric and potentiometric titrations have been carried out with dextrin and sol. starch highly purified by electro-dialysis and electro-decantation. Both substances are separable into fractions containing and not containing P. The titrations afford evidence of a large no. of acidic (regarded as uronic acid) groups in addition to those containing P. In dextrin both charged and uncharged particles co-exist and can be separated by electro-decantation. The P-free dextrin fractions have a dissociation const. which decreases rapidly with dilution. Explanations based on constitution are offered. F. L. U.

Hydration of hydrophilic colloids, especially polymeric carbohydrates. P. KOETS and H. R. KRUYT (Kolloid-Z., 1938, **82**, 315—318; cf. A., 1938, I, 79).—The behaviour of carbohydrates towards H_2O, with respect to their tendency to polymerise, is determined by the relative dominance of mol. cohesion and internal hydration due to the presence of polar groups. The theory is illustrated by reference to glucose, glycogen, starch, and cellulose. F. L. U.

Solvation of colloid particles. (MME.) A. DOBRY (J. Chim. phys., 1938, **35**, 20—26).—The vol. occupied by the particles of cellulose esters in $COMe_2$ solutions has been deduced from measurements of electrical conductivity. The max. vol. is 4 times that of the

ester in the dry state; the amount of solvent bound is hardly sufficient to form a unimol. film. E. S. H.

Electrical charges of aqueous colloidal systems. I. KEMP (Trans. Electrochem. Soc., 73, Preprint 11, Advance copy, 165—170).—The mobilities of 15 colloidal substances in solutions of const. ionic strength (0·01) show in every case a decrease with increase of p_H. The substances fall into three groups, viz., (1) hydrophobic substances (*e.g.*, paraffin) which have negative mobilities from 0 at p_H 2 to -7 μ. per sec. at p_H 8—9; (2) long-chain compounds with separated polar and non-polar constituents, with mobility 0 at p_H 2 to -4 or -5 μ. per sec. at p_H 8—9; and (3) strongly hydrophilic substances (*e.g.*, proteins and carbohydrates) with mobility varying from 0 to 2 at p_H 2 to -2 or -3 μ. per sec. at p_H 9. In general, the mobility at p_H >7 increases in passing from hydrophilic to hydrophobic colloids. F. L. U.

Reciprocity theorem in colloid optics and its generalisation. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1938, 7, A, 21—34; cf. A., 1937, I, 182, 409, 460, 514, 614).—The reciprocity theorem $\rho_u = (1 + 1/\rho_h)(1 + 1/\rho_v)$ which expresses the connexion between the three depolarisation factors ρ_u, ρ_v, and ρ_h for the case of transverse and oblique scattering is deduced and verified experimentally for a solution containing a large no. of particles which have no preferred orientation in the plane of the incident and scattered beams. F. J. L.

Charged colloid particles in an ultrasonic field. J. J. HERMANS (Phil. Mag., 1938, [vii], 25, 426—438).—Theoretical. The diffuse double layer around a colloidal particle loses its spherical symmetry under the influence of ultrasonic waves, and a dipole moment results. A p.d. should be set up between a node and an antinode of the wave, the magnitude of which depends on the apparent mass of the particles and their charge. It may amount to approx. 0·01 v. H. J. E.

Viscosity of cellulose solutions. III. G. SAITO (J. Soc. Chem. Ind. Japan, 1938, 41, 31—34B; cf. B., 1936, 635).—The mean distance between the centres of compact particles is equal to that for stretched particles but the mean min. distance is less for the latter in solutions of equal concn. containing the same no. of particles. The application of this result to the theory of η for stretched particles of compounds of high mol. wt. in dil. solutions is discussed. K. W. P.

Structure formation in sols of mercurised sulphosalicylic acid. I. A. I. RABINERSON and M. A. KULAKOV (J. Gen. Chem. Russ., 1937, 7, 2729—2737).—Variations in the η of the sols (Ostwald and Mertens, A., 1926, 1097) with age, concn., p_H, and concn. of neutral salts are recorded. R. T.

Emulsions of the type phenol–sodium oleate–xylene. I. S. VEICHHERTZ and A. V. SOKOLOVA (Trans. Inst. Fert. Insectofung. U.S.S.R., 1935, 123, 227—234).—Na oleate and PhOH do not react. Stable emulsions without PhOH can be produced only with the application of mechanical energy. PhOH lowers the surface potentials in the presence of small amounts of emulsifiers. CH ABS. (e)

Adsorption layers in disperse systems. XVII. Peptising and coagulating faculty of sodium oleate and rosin soap; influence of electrolytes. N. N. SERB-SERBINA (J. Phys. Chem. Russ., 1937, 10, 813—821).—The influence of NaOH, HCl, NaCl, Na_2CO_3, and Na_3PO_4 on the peptisation and flotation of graphite by Na oleate and abietate has been investigated. J. J. B.

Exchange adsorption on colloidal aluminium hydroxide. V. A. KARGIN and N. A. OGANDSHANOVA (J. Phys. Chem. Russ., 1937, 10, 782—787).—When a sol containing approx. 0·8 Cl for 1 Al_2O_3 and its ultrafiltrate were pptd. by Na_2SO_4, the ppts. were found to contain approx. 0·5 SO_4 for 1 Al_2O_3. J. J. B.

Amorphous and crystalline hydrated oxides and oxides. XL. Osmotic theory of ageing of metal hydroxide gels applied to amorphous ferric hydroxide. Hindrance to ageing by preventing loss of water and maintaining turgescence. A. KRAUSE and E. BORZESZKOWSKI (Kolloid-Z., 1938, 82, 312—314).—The ageing of amorphous $Fe(OH)_3$ can be prevented by sufficiently increasing the osmotic pressure of the solution in which it is immersed. After 5 months' storage under 4·9N-NaCl a specimen remained completely amorphous, whilst those kept under N-NaCl or H_2O gave an *X*-ray pattern of α-Fe_2O_3. The results are explained on the basis of the theory previously put forward (A., 1937, I, 629). F. L. U.

Ageing of fresh precipitates in presence of liquid. I. M. KOLTHOFF (Österr. Chem.-Ztg., 1938, 41, 113—118).—A lecture. F. L. U.

Ageing of fresh precipitates. XIX. Ageing of freshly precipitated barium sulphate in dilute barium and sulphate solutions. XX. Ageing of freshly precipitated barium sulphate. XXI. Properties of barium sulphate precipitated from ammonium acetate medium and the co-precipitation of lead. I. M. KOLTHOFF and G. E. NOPONEN (J. Amer. Chem. Soc., 1938, 60, 499—505, 505—508, 508—511).—XIX. The influence of the composition of the mother-liquor on the speed of ageing of $BaSO_4$ ppts. has been determined. The sp. surface of fresh ppts. increases slightly on ageing for 1 day in 0·005M-$Ba^{"}$, showing that Ostwald ripening does not play a part. Ageing in 0·005M-$SO_4^{"}$ is characterised by a decrease in sp. surface, due to recrystallisation occurring in the liquid film around the particles. The rate of ageing depends on the solubility of the lattice material in the surrounding liquid film.

XX. The ageing of $BaSO_4$ ppts. is inhibited strongly by adsorbed wool-violet and slightly by gelatin. Ageing is retarded in 50% EtOH–H_2O. Ppts. prepared at boiling temp. are very imperfect.

XXI. The amount of Pb co-pptd. with $BaSO_4$ from OAc′ solutions varies with the rate of pptn. The heterogeneous mixed crystals age slowly in the supernatant liquid at room temp., but rapidly at 95°.

The presence of NH_4OAc increases the perfection of crystals of pptd. $BaSO_4$. E. S. H.

Permutite and its properties. N. S. KURNAKOV, L. G. BERG, and V. N. SVESCHNIKOVA (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 1381—1396).—The influence of the conditions of prep. on the properties of the gel formed by mixing slightly alkaline solutions of Na aluminate and silicate has been determined. Increase of alkali concn. or rise of temp. leads to the pptn. of $Na_2O,Al_2O_3,2SiO_2,2H_2O$, which can be obtained in macrocryst. form in strongly alkaline solutions (>20%) at 80—90°. The *X*-ray diagrams of the crystals are similar to those of kaolin and of the product obtained by treating permutite with strong alkali. The amount of SiO_2 in the ppt. increases as the alkalinity of the Na aluminate solution decreases. The base-exchange properties of the ppts. have been investigated. E. S. H.

Application of the dilatometric method to the study of colloidal gels. A. BOUTARIC (Compt. rend., 1938, **206**, 675—677).—The thermal expansion of synthetic resins has been studied. With undried specimens, expansion occurs with increasing temp. up to 80—100°, but at higher temp. contraction is observed; the phenomenon is not reversible in that the specimen shrinks appreciably on cooling. Specimens dried for long periods at 100° show normal linear expansion (coeff. $1{\cdot}5—3 \times 10^{-5}$), and the anomalous expansion is due to the presence of H_2O, probably adsorbed on the surface of the micelles in the mass of the gel. A. J. E. W.

Constitution of a thermo-reversible gel. F. HIRATA (Bull. Chem. Soc. Japan, 1938, **13**, 49—60).—A theoretical relation is derived between the rigidity of a thermo-reversible gel and the dielectric const. of the intermicellar liquid, and is applied to data for gelatin gel. J. W. S.

Preparation of titanic acid gel, and investigation of its adsorptive properties. S. E. VERCHOVSKI, A. K. VERCHOVSKAJA, and M. V. KARTZINEL (J. Appl. Chem. Russ., 1938, **11**, 4—11).—TiO_2 gel adsorbs alkalis, but not acids, from aq. solutions; in presence of salts hydrolytic adsorption is observed. The gel is a highly active adsorbent of gases (NH_3, SO_2). R. T.

Precipitation of gold in silica gels. J. LEBESGUE (J. Chim. phys., 1938, **35**, 33—43).—Periodic structures can be obtained either in the dark or under continuous illumination. Light appears to accelerate the diffusion of $H_2C_2O_4$ in SiO_2 gels. E. S. H.

Periodic sedimentation structures. P. F. MICHALEV (J. Phys. Chem. Russ., 1937, **10**, 881—882).—Boiled $Al(OH)_3$ powder gives rise to periodic structures on sedimentation in H_2O. J. J. B.

Periodic coagulation of gold sol in presence of colloidal silica. W. URE and J. N. WILSON (J. Physical Chem., 1938, **42**, 151—163).—When electrolytes diffuse upwards into tubes containing red Au sol mixed with colloidal silicic acid, a progressive and uniform change to blue is observed if no setting occurs. If the coagulation is accompanied by setting Liesegang rings are formed. The effect of different electrolytes [NaCl, Na_2SO_4, KCl, $AgNO_3$, $AlCl_3$, $Al(NO_3)_3$, phosphate buffers] is sp., but in general increased concn. gives more closely spaced rings. No rings are formed by diffusion of the electrolyte into already set gels. Downward diffusion into a vertical tube or lateral diffusion into a horizontal tube produces a coagulum which sinks to the bottom. An explanation is offered on the assumption that coagulation of the Au is accompanied by adsorption of particles in the adjacent region. F. L. U.

Adsorption in the coagulation of sols by electrolytes. H. B. WEISER, W. O. MILLIGAN, and W. J. COPPOC (J. Physical Chem., 1938, **42**, 427—435).—The decrease in ζ-potential due to contraction of the double layer caused by exchange adsorption of ions is discussed. The pptn. concn. of electrolytes for sols of AgI and As_2S_3 may be > that corresponding with max. adsorption if the sols have a wide range of dispersity, owing to the stepwise character of the coagulation. Thus the concn. of KCl required for complete coagulation of an As_2S_3 sol was 40% > that at which 95% of the disperse phase was pptd. It is suggested that this effect may account for the apparently anomalous behaviour of certain AgI sols studied by Verwey and Kruyt (A., 1934, 253). F. L. U.

Melting temperatures of compounds adsorbed on silica gel. W. A. PATRICK and W. A. KEMPER (J. Physical Chem., 1938, **42**, 369—380; cf. A., 1935, 294).—Heating curves for SiO_2 gel saturated with $C_{10}H_8$, C_6H_6, p-$C_6H_4Mc{\cdot}NO_2$, and H_2O reveal a large heat capacity for the system, over a wide temp. interval below the normal m.p. of the adsorbate, which is taken as evidence of melting. Hysteresis phenomena are observed. In the case of saturated gels melting occurs 40°, 44°, 41°, and 12° below the respective normal m.p. of the substances named above. The quantity melting per 1° is a reproducible function of the temp., independent of the rate of cooling or heating, provided the experiments start from the same low temp. F. L. U.

Structure of thixotropic systems. B. TAMAMUCHI (Bull. Chem. Soc. Japan, 1938, **13**, 234—240).—Coagulation tests with suspensions of a Na-clay indicate that thixotropic gelatinisation is an intermediate stage between partial lyophobic coagulation and complete lyophilic flocculation. In conc. thixotropic systems the theory of "lyospheres," in which strong van der Waals forces are assumed, is satisfactory, but in those of low concn. the structure can be represented as a three-dimensional oriented lattice. Addition of small amounts of lyophilic Na-clay to non-thixotropic $BaSO_4$ suspensions renders the latter thixotropic. J. W. S.

Measurement of thixotropy in absolute units. C. F. GOODEVE and G. W. WHITFIELD (Trans. Faraday Soc., 1938, **34**, 511—520).—A method of measuring thixotropy is described in which equilibrium is established between the building up of the structure and its breakdown under an applied shear. Resistance to flow in this state is considered to be governed by a coeff. of thixotropy (the limiting slope of the viscosity–reciprocal shear curve, as the shear approaches a high val.) and a coeff. for the residual

viscosity. Most systems examined give results in conformity with the theory. F. R. G.

Thixotropy and related properties of kaolin suspensions. B. Tamamushi (J. Chem. Soc. Japan, 1936, **57**, 132—135).—A suspension of 0·5 g. of kaolin in 1·5 c.c. of H_2O shows thixotropy in presence of a neutral salt such as KCl. Ch. Abs. (e)

Electrokinetic aspects of surface chemistry. IV. Ratio of electro-osmosis to electrophoresis. L. S. Moyer (J. Physical Chem., 1938, **42**, 391—395; cf. A., 1938, I, 136).—The ratio of electro-osmotic to electrophoretic mobility of gelatin-coated surfaces is very near 1, even in 0·001% gelatin solutions if the coating is complete. F. L. U.

Comparison of electro-osmosis, electrophoresis, and streaming potential and their theoretical significance. L. S. Moyer (Trans. Electrochem. Soc., **73**, Preprint 15, Advance copy, 215—228).—A summary of work previously published by the author and others. F. L. U.

Optical inactivity of gelatin in the adsorbed state at the liquid/liquid interface and its use as a measure of adsorption. C. S. Narwani and J. B. Sidhwa (J. Indian Chem. Soc., 1938, **15**, 65—71).—The rotatory power of emulsions of amyl acetate in gelatin–H_2O–glycerol sols of various concn. is < that calc. on the basis of Beer's law and it is inferred that gelatin is adsorbed on the ester globules and becomes temporarily optically inactive, due to orientation of mols. at the interface. The quantity of gelatin adsorbed by 1 g. of adsorbent appears to be approx. const. when different amounts of adsorbent are used. M. R.

Spectropolarimetric studies of protein–salt systems. R. Manzoni-Ansidei and M. Toschi (G. Biol. Ind. Agr. Aliment., 1937, **7**, Reprint, 19 pp.).—Measurements of the rotatory power of gelatin–acid systems at p_H vals. < the isoelectric point and at various $\lambda\lambda$ have been made. The results can be expressed satisfactorily by a single term of the Drude equation. The rotatory dispersion consts. depend on the nature of the acid and also for low p_H vals. on $[H^+]$. The results are discussed. O. J. W.

Streaming double refraction and viscosity of sodium caseinate solutions and the influence of neutral salts. H. Nitschmann (Helv. Chim. Acta, 1938, **21**, 315—336).—The positive streaming double refraction of the solutions is decreased slightly by a small addition of NaCl, but further additions are followed by a gradual rise which is almost linear between 2% and 10% NaCl. Low concns. (<1%) of NaCl reduce η, but further additions have only a slight effect. Na_2SO_4 has an effect > NaCl and KI has an opposite effect. NaCl and Na_2SO_4 are considered to cause an increase and KI a decrease in the particle size. C. R. H.

Electrophoretic behaviour in nucleic acid–protein mixtures. E. Stenhagen and T. Teorell (Nature, 1938, **141**, 415).—When seralbumin is electrophorised in presence of nucleic acid the pigment, which could not be separated from protein after repeated electrophoresis, changes its "carrier" and migrates with the acid, leaving behind a colourless albumin. L. S. T.

Hydration and physicochemical properties of pectin and its derivatives. R. F. Stuewer (J. Physical Chem., 1938, **42**, 305—315).—The equiv. wts. of pectin (I), pectinic acid (II), and pectic acid (III) are respectively 848, 425, and 207. (II) was derived by low-temp. acid hydrolysis of (I) and (III) was prepared by alkaline hydrolysis of (I). Conductivity measurements for (I) and (II) and their salts indicate that the acids are weak, but stronger than AcOH. The Na salts are fairly strong electrolytes, and the Ca and Mg salts are far from completely dissociated at 10^{-4}N. The hydrations of (I), (III), Na and Ca pectate, determined by using an inert reference substance at different concns. and extrapolating to zero concn., are respectively 0·25, 0·21, 0·38, and 0·35 g. of H_2O per g. of dry material. Data for the sorption of KIO_3 by the dry substances are recorded. F. L. U.

Gaseous equilibrium of αβ-di-iodobutane, Δ^α-butene, and iodine. J. E. Cline and G. B. Kistiakowsky (J. Chem. Physics, 1937, **5**, 990).—In order to compare the heats of iodination and of hydrogenation of olefines the equilibrium between Δ^α-butene and I_2 has been determined by a photoelectric method at 67° and 81°. The results lead to $\Delta H = 12{\cdot}0 \pm 1{\cdot}5$ kg.-cal. Iodination of butene is less exothermic than that of C_2H_4 and the free energy change is greater by 0·9 kg.-cal.; the relations are thus similar to those shown by the heats of hydrogenation. W. R. A.

Free energy of formation of ethyl propionate. Equilibrium in the gaseous state. H. Essex and M. Sandholzer (J. Physical Chem., 1938, **42**, 317—333; cf. A., 1932, 695).—Equilibria for the gaseous reaction $EtCO_2Et$ (I) + H_2O (II) $\rightleftharpoons$ EtOH (III) + $EtCO_2H$ (IV) catalysed by SiO_2 gel have been reached from both sides, and vals. of $K = a_I a_{II}/a_{III} a_{IV}$ are given for temp. between 155° and 200°. The standard free energy of formation of liquid (I) at 25° is calc. to be −79,634·6 g.-cal. The heat of esterification, calc. from the temp. coeff. of K, is given for liquid and vapour at 25°, and for vapour at 158° and 193°. The vals. so obtained are more accurate than those derived from heats of combustion. F. L. U.

Foundations of a thermodynamic treatment of the theory of solutions. K. Fredenhagen, with a note by E. Hückel (Z. Elektrochem., 1938, **44**, 206—209).—Theoretical. C. R. H.

Van der Waals forces in electrolytes. J. Lange and E. Herre (Z. physikal. Chem., 1938, **181**, 329—354; cf. A., 1934, 596).—Expressions are deduced which give the degree of association for ions of unlike (γ) and for ions of like (δ) sign, in terms of quantities provided by measurements of f.p. and electrical conductivity. Measurements were made with 0·01—0·001N solutions of uni-univalent electrolytes having at least one ion of the inert gas type, the other being in some cases large and strongly polarisable. The electrolytes studied fall into three groups: (1) alkali halides, in which there is no appreciable association except with CsCl, which has $\delta(Cs^+) = 0{\cdot}7\%$;

(2) halogen oxyacid anions with δ vals. of 1—2%; (3) ions containing a C_6H_6 nucleus, which give δ vals. of a higher order of magnitude. $C_6H_3(NO_2)_2\cdot O'$ (2 : 4 : 1) and picrate have δ = 5·7 and 7·2, respectively, whilst methylene-blue has δ = 40% in 0·01N solution. The γ vals. for group (1) and for $C_6H_3(NO_2)_2\cdot ONa$ and Na picrate are negligible, <1% for $KClO_3$, KIO_3, and $KClO_4$, whilst for HIO_3 and picric acid they agree with those calc. from the dissociation const. (α). Calculation of α or γ from conductivity data without reference to δ leads to erroneous results. F. L. U.

Activity coefficient and mean atomic diameter in solutions of mixed electrolytes. I. Cadmium sulphate in presence of potassium nitrate, potassium chloride, and potassium sulphate. II. Cadmium sulphate in presence of magnesium nitrate, magnesium sulphate, and lanthanum sulphate. H. I. STONEHILL (Trans. Faraday Soc., 1938, **34**, 533—544, 544—554).—I. The activity coeff. (*f*) of $CdSO_4$ has been determined potentiometrically at 25° and 30° in presence of KNO_3, KCl, and K_2SO_4, with varying concns. of each solute. Mean at. diameters (*a*) calc. from the Debye–Hückel equation are variable and often negative, and this expression, even when corr. for the variation of ε with concn., cannot be used for calculating *f*. The La Mer equations lead to exclusively positive vals. which, however, are also variable. In both cases *a* is independent of the concn. scale (wt. or vol.) used, and has a zero or small negative temp. coeff. The calc. vals. bear no apparent physical relation to either crystallographic diameters of single ions or La Mer mean ionic diameters for single electrolytes.

II. Similar results are obtained in presence of $Mg(NO_3)_2$, $MgSO_4$, and $La_2(SO_4)_3$. The failure of the Debye–Hückel equation cannot be ascribed to incomplete dissociation or to partial association of oppositely charged ions. F. L. U.

Raman investigation of the possible existence of inorganic complexes in solution. H. G. HOULTON and H. V. TARTAR (J. Amer. Chem. Soc., 1938, **60**, 549—550).—New lines for $MnSO_4$ and $(NH_4)_2SO_4$ have been determined, but no evidence has been found for the existence of complexes in their aq. solutions. E. S. H.

Halogen equilibria in heavy water. E. ABEL and F. FABIAN (Monatsh., 1938, **71**, 241—250; cf. A., 1938, I, 202).—Measurements of the partition coeff. of Br and I between D_2O and H_2O at 25° are recorded. The difference between D_2O and H_2O is very small. Replacement of H_2O by D_2O favours dissociation of the Br_3' and I_3' ions. The degree of hydrolysis of Br in D_2O, measured conductometrically, is < that in H_2O. A slow increase with time in the conductivity of solutions of Br in D_2O is observed. In H_2O the increase is much slower. It is attributed to the liberation of O_2. H. J. E.

Theory and experimental demonstration of molecular association. H. HARALDSEN (Tids. Kjemi, 1938, **18**, 28—34).—A review. M. H. M. A.

First-stage dissociation constant of hydrogen sulphide. A. G. EPPRECHT (Helv. Chim. Acta, 1938, **21**, 205—211).—Glass electrode measurements lead to a val. $K_1 = 3{\cdot}313 \times 10^{-7}$, corresponding with a normal acidity potential of 374·54 mv. C. R. H.

Chemical constitution and dissociation constants of monocarboxylic acids. IX. Mono-substituted β-phenylpropionic and cinnamic acids. J. F. J. DIPPY and J. E. PAGE (J.C.S., 1938, 357—363; cf. A., 1938, I, 30).—The thermodynamic dissociation consts. of *o*-, *p*-, and *m*-methyl-, -methoxy-, -chloro-, and *o*- and *p*-nitro-β-phenylpropionic, *o*-, *m*-, and *p*-methyl-, -methoxy-, -nitro-, *o*- and *m*-hydroxy-, and *m*-chloro-cinnamic, and 3-nitro-*o*-toluic acids have been determined conductometrically in H_2O. The data are discussed in relation to the strengths of the corresponding benzoic and phenylacetic acids from the viewpoint of the electronic theory of valency. The linear relation between dissociation consts. and dipole moments of substituted benzenes has been re-examined and confirmed in the light of new vals. for the dipole moments. The relation also holds for the substituted β-phenylpropionic, but not for the cinnamic, acids. E. S. H.

Base strength of amine and phosphine oxides. P. NYLÉN (Tids. Kjemi, 1938, **18**, 48—50).—Vals. for pK_A (20°) which represent the dissociation consts. of the corresponding acids formed by proton addition have been found for six alkyl- and aryl-amines; these range from 4·21 to 5·13. PMe_3O and PEt_3O have no measurable basic properties. *Diethylaniline*, *dimethyl-o-toluidine*, and *dimethyl-p-toluidine oxide hydrochlorides*, m.p. 141° (decomp.), 145° (decomp.), and 128° (decomp.), respectively, have been prepared. M. H. M. A.

Dissociation constants, solubilities, etc. of pantocaine and novocaine bases. J. EISENBRAND and H. PICHER (Arch. Pharm., 1938, **276**, 185).—Errata (see A., 1938, I, 140).

Dissociation of aconitic acid into the labile molecule $CH\cdot CO_2H$ at the mercury–water interface. G. SEMERANO [with G. BETTINELLI] (Mem. R. Accad. Ital., 1937, **8**, 243—253; cf. A., 1937, II, 245).—Potentiometric data for the reduction of aconitic acid at the dropping Hg cathode suggest the equilibrium $C_3H_3(CO_2H)_3 \rightleftharpoons 3CH\cdot CO_2H$, and reduction of the resultant labile mol. The formation of $(CH_2\cdot CO_2H)_2$ is said to occur by way of the labile mol. $CH_2\cdot CO_2H$. The molar reduction potential (cf. A., 1932, 1093) is −0·494 v. In presence of tropæolin, the max. of current intensity is suppressed (cf. A., 1934, 258), and the cathodic process is represented by the equation $C_3H_3(CO_2H)_2 + 2H^+ + 2\ominus \rightarrow CO_2H\cdot CH(CH_2\cdot CO_2H)_2$. E. W. W.

Electrolytic dissociation constant of the labile acid $CH\cdot CO_2H$, and the degree of depolymerisation of maleic, fumaric, and aconitic acids. G. SEMERANO [with G. BETTINELLI] (Mem. R. Accad. Ital., 1937, **8**, 255—294).—The reduction of maleic (I) and fumaric (II) acids (cf. A., 1937, II, 245) and of aconitic acid (III) (cf. preceding abstract) at the dropping Hg cathode is studied and discussed in detail. The current–potential curve shows up to

6 points of inflexion, which vary as HCl or LiOH is added. The vals. of the dissociation const. calc. from the first potential (reduction of neutral mol.), viz., (I), 2·1; (II), 2·7; and (III), 2·2, each $\times 10^{-4}$, are approx. equal, and considerably < those given in the literature; they suggest the presence of a single acid, weaker than (I), (II), and (III), *i.e.*, the labile acid $CH{\cdot}CO_2H$ (IV), for which the dissociation const. $3{\cdot}6 \times 10^{-4}$ is calc. It is inferred that at the Hg–H_2O interface (I) is 90%, (II) 60%, and (III) 70% converted into (IV). E. W. W.

Comparative physical properties of calcium ascorbate and gluconate. S. Ruskin (Amer. J. Pharm., 1938, **110**, 64—66).—The fraction of Ca ascorbate ionised in 5, 10, 20, and 30% aq. solution is 0·746, 0·600, 0·581, and 0·553, respectively. Ca ascorbate yields 20—60 times the concn. of $Ca^{\cdot\cdot}$ given by equiv. solutions of Ca gluconate. The theory is advanced that ascorbic acid participates with the parathyroid hormone in forming diffusible serum-$Ca^{\cdot\cdot}$. F. O. H.

Interchange reactions of oxygen. II. Interchange of oxygen between water and acetaldehyde. J. B. M. Herbert and I. Lauder (Trans. Faraday Soc., 1938, **34**, 432—435).—Equilibrium in the reaction $MeCHO + H_2{}^{18}O \rightleftharpoons CHMe(OH){\cdot}{}^{18}OH$ is reached in about 100 hr. with ^{18}O evenly distributed. The rate of O exchange supports Wieland's mechanism (A., 1912, i, 944) for the oxidation of MeCHO in presence of Pd-black. F. R. G.

Thermodynamic and kinetic considerations of the vapour pressure lowering of solutions. (A) K. Fredenhagen. (B) K. F. Herzfeld (Physikal. Z., 1938, **39**, 317—325, 325—326).—(A) A reply to Herzfeld (A., 1937, I, 136). Lowering of v.p. of a solvent is not conditioned by the mere presence of a second substance. Lowering occurs only when the solvent itself is affected by the solute (*e.g.*, in degree of association, or heat of vaporisation), and these changes are in themselves sufficient to explain the v.p. reduction. The lowering obeys Raoult's law if the processes occurring in the formation of the solution are covered either by Planck's equations or by Fredenhagen's equations. In the former case the lowering of the v.p. is ascribed to change in vol. of the solvent and in the latter to a diminution in the no. of free solvent mols. The theory of Fredenhagen is not in contradiction with Planck's views, but is a logical development of them.

(B) A reply to the above. A. J. M.

Potentiometric determination of time–temperature curves in thermal analyses. C. Perrier and A. Bellanca (Atti R. Accad. Lincei, 1937, [vi], **26**, 245—251).—A method is described and measurements on the systems KCl–KBr and K_2SO_4–Na_2SO_4 are recorded. O. J. W.

System carbon–hydrogen–methane between 442° and 712°. M. W. Travers (Trans. Faraday Soc., 1938, **34**, 580—584).—At 712° the equilibrium reactions are normal and are represented by $C + 2H_2 \rightleftharpoons CH_4$. At 574° the val. of $p_{H_2}{}^2/p_{CH_4}$ falls steadily with decreasing total pressure, whilst that of $p_{H_2}{}^2/p_{CH_4}$ is nearly const. It is suggested that below 600° the almost complete saturation of the C with H_2 leads to the formation of a phase represented by $:CH_2$, from which CH_4 is formed by a reaction $:CH_2 + H_2 \rightleftharpoons CH_4$. From experiments at 525°, 478°, and 442°, $\Delta H = 8$ kg.-cal. The different types of reaction occurring above and below a transition temp. between 600° and 700° are related to the transition exhibited in the carbonisation of coal at about the same temp. F. L. U.

System sodium metasilicate–water from 90° to the ice point. C. L. Baker and L. R. Jue (J. Physical Chem., 1938, **42**, 165—169).—Solubilities are given. M.p. are as follows: $Na_2SiO_3{,}5H_2O$ 72·20°; $6H_2O$ 62·85°; $8H_2O$ 48·35°; $9H_2O$ 47·85°, all $\pm 0{\cdot}05°$. F. L. U.

System potassium sulphate–potassium sulphide. J. Goubeau, H. Kolb, and H. G. Krall (Z. anorg. Chem., 1938, **236**, 45—56).—The system K_2SO_4–K_2S has been examined by means of cooling curves and *X*-rays. K_2SO_4 forms solid solutions with up to approx. 30% of K_2S. There is a *compound*, $K_2SO_4{,}3K_2S$, m.p. 759° approx., and two eutectics with 56% and 72·5% K_2S, at 587° and 730°. The m.p. of K_2S is 912°. $K_2SO_4{,}3K_2S$ is cubic, a 9·22 A. F. J. G.

Phase diagram of the system magnesium sulphide–magnesium oxide, and the properties of the oxide separating from the system. A. S. Mikulinski and V. D. Kamkin (J. Appl. Chem. Russ., 1938, **11**, 16—24).—The reaction $MgO + FeS + C \rightarrow MgS + Fe + CO$ commences at about 1200°, and reaches completion after 4 hr. at 1350°. The fluidity of the system is at a max. when it contains 66% of MgS; Fe readily separates from the melt at 1600—1800°, and crystals of periclase are identified in the solidified melt. The melts can be converted into MgO containing 75—85% of periclase by heating at 700—800° for 8 hr. in a stream of air, and into MgO–$Mg(OH)_2$ mixtures by treatment with boiling H_2O. R. T.

Chemical systems of the Lenard phosphors. III. R. Schenck, W. Kroos, and W. Knepper (Z. anorg. Chem., 1938, **236**, 271—295).—The systems CaS–Sb_2S_3, SrS–Sb_2S_3, BaS–Sb_2S_3, SrS–Ag_2S, BaS–Ag_2S, and ZnS–Ag_2S have been studied by measurements of the H_2–H_2S equilibrium in the gas phase. Sb_2S_3 with the alkaline-earth sulphides forms *compounds* of the types MSb_2S_4 and $M_2Sb_2S_5$; these are mutually sol., and the second dissolves to a small extent in the alkaline-earth sulphide. BaS and Ag_2S form *compounds* $2Ag_2S$,BaS and Ag_2S,BaS, and the latter dissolves to a small extent in BaS. SrS and Ag_2S do not form complex phases. ZnS takes up 5% of Ag_2S in solid solution. F. J. G.

Thermal dissociation of silver sulphide. A. A. Voevodski and K. A. Golbert (J. Phys. Chem. Russ., 1937, **10**, 831—843).—The disagreement between earlier measurements of the Ag_2S dissociation cannot be explained by the slowness of diffusion in the gas phase. New measurements carried out both statically and dynamically give for the equilibrium const. K of the reaction $Ag_2S + H_2 \rightleftharpoons 2Ag + H_2S$, $\log K = 294{\cdot}1/T - 0{\cdot}8963$ between 557° and 753° and log

$K = 645{\cdot}0/T - 1{\cdot}24$ between 753° and 922°. From these vals. thermodynamical data for Ag_2S are calc. J. J. B.

The binary system CCl_4–EtOH. F. Ishikawa and T. Yamaguchi (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 246—255).—V.p.–composition curves for liquid and vapour phases and partial pressure curves for both components have been determined at 25°. A large positive deviation from Raoult's law is observed. Activities, activity coeffs., etc. are calc. for each component. T. H. G.

Behaviour of sulphur in molten naphthalene. V. I. Ezdakov (J. Gen. Chem. Russ., 1937, **7**, 2704—2709).—F.p. determinations in the system $C_{10}H_8$–S are recorded. R. T.

Solubility of the components in their crystallised compounds. G. Tammann (Z. anorg. Chem., 1938, **236**, 306—309).—Theoretical. From considerations of the form of the equilibrium diagram at lower temp., a method is suggested for determining whether or not a max. of the f.-p. curve represents a definite compound. F. J. G.

System nickel sulphate–sulphuric acid–water at 25° and 0°. J. A. Addlestone (J. Physical Chem., 1938, **42**, 437—440).—Isotherms at 25° and 0° have been determined. The stable solid phases at 25° are: $NiSO_4,7H_2O$, $NiSO_4,6H_2O$, $NiSO_4,H_2O$, $NiSO_4$; and at 0°: $NiSO_4,7H_2O$, $NiSO_4,6H_2O$, $NiSO_4,H_2O$, H_2SO_4,H_2O. A metastable tetrahydrate was found at 25° for $[H_2SO_4]$ between 45 and 50%. F. L. U.

Solid solutions of the glaserite type of sodium and potassium sulphates and chromates. S. Z. Makarov and I. G. Drushinin (Bull. Acad. Sci., U.R.S.S., 1937, Sér. Chim., 1291—1339).—The systems K_2SO_4–Na_2SO_4–H_2O and K_2CrO_4–$NaCrO_4$–H_2O yield, respectively, the compound $3K_2SO_4,Na_2SO_4$, which forms a limited series of solid solutions with Na_2SO_4, and $2K_2CrO_4,Na_2CrO_4$, which forms a limited series of solid solutions with Na_2CrO_4 and K_2CrO_4. E. S. H.

System mercuric iodide, cæsium iodide, and water. (Mlle.) M. Pernot (Compt. rend., 1938, **206**, 909—911; cf. A., 1936, 429).—The compounds $3HgI_2,2CsI$, $HgI_2,2CsI$, and $HgI_2,3CsI$ occur as solid phases over the whole temp. range investigated (0—78°); HgI_2,CsI has been found at 0° and 12°, and $2HgI_2,CsI$ at 78° (cf. also A., 1893, ii, 68). A. J. E. W.

System CaO–Al_2O_3–Fe_2O_3. B. Tavasci (Annali Chim. Appl., 1937, **27**, 505—518).—Triangular diagrams for the system have been derived from photomicrographic data. O. J. W.

Equilibrium of the system TiO_2–SO_3–H_2O at 150°. T. Sagawa (J. Soc. Chem. Ind. Japan, 1938, **41**, 27B).—Four sulphates, with $TiO_2 : SO_3 : H_2O$ ratios = 6 : 5 : 4 (I), 1 : 1 : 1, 1 : 1 : 0, and 2 : 5 : 5 (II), are present in the solid phase at 150°. (I) and (II) are new *compounds*. Max. $[SO_3]$ for pptn. of TiO_2 by hydrolysis is 36·2%, compared with 34·5% at 100°, and the TiO_2 solubility is reduced. The ppt. contains 1—3·3% SO_3, depending on $[SO_3]$ in the liquor. The TiO_2 content is 93—95% compared with 92—93% at 100°. Only (II) is readily sol. in H_2O. I. C. R.

Ternary systems. XXII. Formation of solid solutions from alums. A. E. Hill and N. Kaplan (J. Amer. Chem. Soc., 1938, **60**, 550—554).—Equilibrium data for the system $(NH_4)_2SO_4$–$Al_2(SO_4)_3$–H_2O at 25° are recorded. The NH_4 and K alums give a continuous series of solid solutions, in which the ratio of the two salts between the liquid and solid phases is const. The Na and NH_4 alums do not form solid solutions at 25°. The NH_4–Fe^{III} and NH_4–Al alums form a continuous series of solid solutions, in which there is always excess of Fe^{III} alum in the aq. phase. In the alums the rate of diffusion in the solid phase is sufficiently great to play a measurable part in the attainment of equilibrium. E. S. H.

Isomorphous salts as solid phases of saturated solutions of three salts of the same ion and reciprocal salt pairs. II. Mixed crystals between double salts. E. Jänecke (Z. Elektrochem., 1938, **44**, 183—193).—Combinations of congruent and incongruent double salts have been examined in the following systems: $Cu^{\cdot\cdot}$–$NH_4^{\cdot}$–$K^{\cdot}$–SO_4''–H_2O at 25°; $Mg^{\cdot\cdot}$–$K^{\cdot}$–Cl'–Br'–H_2O at 20°; $Mg^{\cdot\cdot}$–$NH_4^{\cdot}$–$K^{\cdot}$–SO_4''–H_2O at 30°; $Mg^{\cdot\cdot}$–$Rb^{\cdot}$–$K^{\cdot}$–Cl'–H_2O at 25°; $Hg^{\cdot\cdot}$–$NH_4^{\cdot}$–$K^{\cdot}$–Cl'–H_2O at 25° (cf. A., 1938, I, 82). C. R. H.

Theory of reduction equilibria in the system Zn–C–O. F. Meunier (Bull. Soc. chim. Belg., 1938, **47**, 99—128).—A crit. discussion of published data. E. S. H.

Polythermal method of investigation of complex salt systems. A. G. Bergman (Trans. VI Mendeleev Congr., 1935, 1932, **2**, Pt. 1, 636—637).—The method consists in the determination of the appearance and disappearance of the first crystals. Difficulties connected with the transformation of solid phases are eliminated. Ch. Abs. (*e*)

Decomposition of silver nitrite. M. Randall, G. G. Manov, and O. L. I. Brown (J. Amer. Chem. Soc., 1938, **60**, 694—697).—The equilibrium $2AgNO_2(s) = Ag(s) + AgNO_3(s) + NO(g)$ has been measured. Vals. of $\Delta(F^\circ - H^\circ_0)/T$ have been calc. from published data. The standard free energy, heat content, and entropy increases at 25° have been calc. by three independent methods. E. S. H.

Modified phase rule equation. S. T. Bowden (Nature, 1938, **141**, 331).—The original definitions of phases and degrees of freedom are retained, but C is the total no. of chemical constituents, *i.e.* chemical substances. The equation is written $P + F + R = C + 2 - r$, where R is the no. of reversible chemical reactions occurring in the system, and r is equal to the no. of pairs of phases having the same concn. or composition. This equation, can be applied without reference to stoicheiometric equations and avoids the difficulties associated with a choice of components. It also leads to a differentiation between physical and chemical change in transition processes. L. S. T.

Salicylic acid and benzophenone as secondary thermochemical standards. O. I. Tschalenko and I. P. Krivobabko (Ukrain. Chem. J., 1938,

13, 40—45).—The heat of combustion of salicylic acid (I) increases from 5241·2 to 5250·2 at 20°, and from 5236·0 to 5245·0 g.-cal. at 15°, when the sample is kept for 2 months over P_2O_5; the effect is ascribed partly to drying, and partly to formation of salicyl salicylate. Under similar conditions $COPh_2$ gives unvarying results during 6 months, and is hence a suitable secondary standard. R. T.

Heat of formation and specific heat of molybdenum nitride. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 362—371).—The mean sp. heat of Mo_2N has been determined for three temp. ranges and an expression derived for the true sp. heat from 0° to 500°. From this the heat of formation is deduced and the heats of formation of the nitrides of elements of period IV and of groups VI and VII are discussed in relation to their at. nos. T. H. G.

Heat of formation of tetracalcium aluminium ferrite. T. THORVALDSON, R. R. EDWARDS, and E. C. BAILEY (Z. anorg. Chem., 1938, **236**, 310—319).—From measurements of the heat of dissolution in HCl, the heat of formation of $4CaO,Al_2O_3,Fe_2O_3$ from its constituent oxides has been found to be 26·6 kg.-cal. per g.-mol. F. J. G.

Thermodynamic properties of zinc chloride ammoniates in the liquid and vapour phases. A. KRASNOV and E. STAROKADOMSKAJA (Izvest. Teplotech. Inst., 1935, No. 11, 44—49). CH. ABS. (e)

Thermal decomposition of some chlorine compounds of the platinum metals. F. PUCHE (Ann. Chim., 1938, [xi], **9**, 233—322).—The compounds examined, and the heats of decomp. (q) in kg.-cal. where determined, were: $PdCl_2$, 36·3; K_2PdCl_6, 18·0; Rb_2PdCl_6, 20·0; K_2PdCl_4; $BaPdCl_4$; K_2OsCl_6, 35·75; Na_2OsCl_6, 34·25; $BaOsCl_6$, 30·75; K_2IrCl_6; K_3IrCl_6; Rb_2IrCl_6, 37·5; Na_2IrCl_6; Na_3IrCl_6; $RhCl_3$, 38·65; Na_3RhCl_6, 38·3; K_3RhCl_6, 38·5. Unlike the Pt compounds, the palladichlorides are less stable than the palladochlorides. Iridochlorides are slightly less stable than iridichlorides. $PdCl_2$ melts at 678°, the heat of fusion being 9·7 kg.-cal. For the same anion complex, the stability decreases in the order Rb > K > Na > Ba. The mean val. of q/T (T = normal dissociation temp.) is 0·0324. The application of Nernst's approx. equilibrium formula is discussed (cf. A., 1935, 447, 703; 1936, 689). C. R. H.

Data on theoretical metallurgy. VIII. Thermodynamic properties of metal carbides and nitrides. K. K. KELLEY (U.S. Bur. Mines, Bulletin 407, 1937, 1—66; cf. A., 1938, I, 198).—Heats and free energies of formation, and in some cases sp. heats, have been calc. for CH_4, Al_4C_3, CaC_2, $CaCN_2$, Cr_5C_2, Cr_3C_2, Co_3C, Fe_3C, Mn_3C, Mn_3C_4, Mo_2C, Ni_3C, SiC, ThC_2, TiC, UC_2, ZrC, NH_3, AlN, Ba_3N_2, BN, Ca_3N_2, CeN, CrN, Fe_4N, LaN, Li_3N, Mg_3N_2, Mn_5N_2, Mn_3N_2, Si_3N_4, Sr_3N_2, TaN, Th_3N_2, TiN, U_3N_4, VN, and ZrN. Results are applied to the carburation of Fe by CH_4, the debismuthising of Pb by Ca through the medium of CaC_2, the partition of C between Mn and Fe in the γ-range, the possibility of producing NH_3 from natural gas and a catalyst, and of cyanides from CO and NH_3, and the decarburisation of Cr. R. S. B.

Determination by a direct method of the heat of ozonation of some compounds containing double bonds. E. BRINER, K. RYFFEL, and S. DE NEMITZ (Helv. Chim. Acta, 1938, **21**, 357—363).—The heat of ozonation, q, has been deduced from the heats of combustion of compounds and their ozonides. Vals. of q for eugenol, *iso*eugenol, safrole, *iso*safrole, anethole, Et maleate, and Et fumarate are of the order of 100 kg.-cal., and indicate a strong union between the three O atoms and the rest of the ozonide mol. C. R. H.

Heats of combustion and intramolecular arrangement. H. DUNKEN and K. L. WOLF (Z. physikal. Chem., 1938, **B**, **38**, 441—450).—The energy contents of gaseous mols. of isomeric tartaric acids and derived esters have been calc. from the heats of combustion and of sublimation. The at. arrangement in these mols. is discussed on the basis of these data. H. J. E.

Thermochemistry of [organic] sulphur compounds. M. BRUTZCUS (Compt. rend., 1938, **206**, 838—839; cf. A., 1938, I, 83).—The energy vals. of the S:S, C·S, and S·H linkings are discussed, and methods derived by which the thermochemical consts. of any compound containing C, H, O, and S may be calc. A. J. E. W.

Thermochemistry of hydroxycarbonyl aromatic derivatives. R. MANZONI-ANSIDEI and M. ROLLA (G. Biol. Ind. Agr. Aliment., 1937, **7**, Reprint, 6 pp.).—The heats of combustion of *o*-, *m*-, and *p*-hydroxyacetophenone and of 4-acetyl-, 2 : 4- and 4 : 6-diacetyl-resorcinol have been measured. O. J. W

Thermal chemistry of *d*-glucose and other glucose sugars in sodium hydroxide solutions. B. C. HENDRICKS and W. H. STEINBACH (J. Physical Chem., 1938, **42**, 335—342; cf. A., 1934, 256).—Heats of reaction (q) of *d*-glucose (equilibrium mixture) (I), α-*d*-glucose (II), β-*d*-glucose (III), and α-methyl-*d*-glucoside (IV) with aq. NaOH increase with increasing NaOH concn. Vals. of q for (II) are slightly > those for (III), whilst for [NaOH] >2N the vals. for (I) are increasingly > those for both (II) and (III) with increasing alkali concn. At all concns. >0·5N vals. of q for (IV) are 4·52± 0·42 kg.-cal. < the corresponding vals. for (II) and (III). The greater part of the heat measured is attributed to salt formation. The usefulness of the adiabatic calorimeter in the study of sugar solutions is emphasised. F. L. U.

Conductance of dilute solutions of potassium ferrocyanide. E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, **60**, 728—729).—Between the concns. 0·000094 and 0·000044M the equiv. conductance is given by $741·56—4621/c$. There is no evidence of curvature up to 0·00075M. E. S. H.

Conductivity and refractive index of aqueous aluminium periodate dodecahydrate. V. BIBER and E. BRANDT (J. Gen. Chem. Russ., 1937, **7**, 2794—2800).—The conductivity and n of aq. solutions have been determined for a range of concns. at 10—60°. R. T.

Effect of frequency on conductivity of strong electrolytes up to high field strength. H. FALKENHAGEN and H. FLEISCHER (Physikal. Z., 1938, **39**, 305—309).—Theoretical. The theory of the variation of conductivity of strong electrolytes with frequency has been extended to high field strengths, assuming that the electrolyte is symmetrical and the ions have the same mobility. For comparatively low field strengths the conductivity increases with both frequency and field strength. At higher fields the conductivity increases with field strength, but decreases with increasing frequency. A. J. M.

Conductivity of salt solutions in water–pyridine mixtures. L. A. SCHRIJVER and A. E. VAN ARKEL (Rec. trav. chim., 1938, **57**, 291—302).—The conductivities of solutions of LiCl, NaCl, $AgNO_3$, $CaCl_2$, and $CdCl_2$ have been determined in C_5H_5N–H_2O mixtures containing 18·6 mol.-% of C_5H_5N, and of 1/30N solutions of salts in mixtures containing 0—100% of C_5H_5N, at 25°. Results are discussed in terms of solvation and incompleteness of dissociation. R. S. B.

Standard electromotive force of the lead electrode. J. J. LINGANE (J. Amer. Chem. Soc., 1938, **60**, 724—725).—The val. 0·1264 v. is calc. from published data. E. S. H.

Potentials of zinc and cadmium in solutions containing foreign ions. J. A. BOLTUNOV (J. Gen. Chem. Russ., 1937, **7**, 2831—2837).—Cd or Zn electrodes in solutions of Na, Ca, or Mn chlorides, sulphates, or nitrates give stable, reproducible potentials, the magnitude of which $\propto$ log concn.; the result cannot be explained in terms of the adsorption of ions at the metal surface. This is, however, applicable to the potentials given by PbS electrodes in $Pb(NO_3)_2$–H_2S, or by AgCl electrodes in $AgNO_3$–HCl. R. T.

Potential of cadmium in cadmium benzenesulphonate [solutions]. (MLLE.) M. QUINTIN (Compt. rend., 1938, **206**, 902—903; cf. A., 1937, I, 187).—The e.m.f. of the cell Cd amalgam–$(PhSO_3)_2Cd$ (concn. *c*)–saturated KCl–0·1N-KCl–Hg_2Cl_2, Hg has been measured for vals. of *c* between 0·001 and 0·08 g.-mol. per l. E_{Cd} is abnormally high at high dilutions, and the relations observed are not in accord with the Debye–Hückel theory. The anomalies are attributed to hydrolysis. A. J. E. W.

Radius of the copper ion in solutions of [copper] benzenesulphonate. (MLLE.) M. QUINTIN (Compt. rend., 1938, **206**, 663—664).—The ionic radius of $Cu^{\cdot\cdot}$ (*r*) in aq. solutions of $(PhSO_3)_2Cu$ has been calc. from previous experimental results for E_{Cu} (A., 1937, I, 187). Using the simple Debye–Hückel formula for log $f_\pm$, const. vals. of *r* are not obtained for high dilutions. The formula of Gronwall, La Mer, and Greiff gives const. vals. of *r* for dilutions up to 0·001 g.-mol. per l. The val. obtained is > that for $Cu^{\cdot\cdot}$ in $CuSO_4$ solutions. A. J. E. W.

"Normal potential" of deuterium. E. ABEL and O. REDLICH (Z. Elektrochem., 1938, **44**, 204—205).—The calc. val. is +44 mv. C. R. H.

Application of the glass electrode to the determination of oxidation–reduction potentials. F. L. WYND (Ann. Missouri Bot. Gardens, 1935, **22**, 861—865).—A review. CH. ABS. (*e*)

Polarity changes of elements when in various combinations of couples to form a cell. L. A. G. BLANCHET (Physical Rev., 1936, [ii], **50**, 391—392).—A polarity determinant has been found from the polarity changes determined for the elements in various combinations of couples placed in a solution to form a cell. The order of the elements given by this determinant differs from that in the e.m.f. series. The polarity that will be shown by any two elements coupled in an electrolyte to form a cell can be predicted. L. S. T.

Temperature coefficient of the electromotive force of a galvanic cell, and the solvent. A. S. AFANASIEV and V. K. ROSTOVZEVA (J. Phys. Chem. Russ., 1937, **10**, 872—880).—The e.m.f. of cells of the type Pt|quinhydrone, aq. HCl|AgCl|Ag has been measured in H_2O, in H_2O–MeOH, and in H_2O–EtOH mixtures between 20° and 40°. J. J. B.

Volta's principle. Origin of the current in the pile. S. J. DOS SANTOS (Rev. Soc. Brasil. Quim., 1937, **6**, 145—150).—A lecture. F. R. G.

Influence of a transverse magnetic field on the thermoelectric power of nickel and of some ferronickels, under tension. G. SIMON and J. BOUCHARD (Compt. rend., 1938, **206**, 667—669; cf. A., 1938, I, 71).—The effect of varying *H*, of the tension in the wires forming the junction, and of the temp. difference between the junctions has been studied for couples of Cu with Ni and six Ni–Fe alloys. A. J. E. W.

Overvoltage. IX. Nature of cathode and anode discharge potentials of several metal surfaces. A. L. FERGUSON and S. KLEINHEKSEL (J. Physical Chem., 1938, **42**, 171—190; cf. A., 1935, 171, 707).—A new experimental arrangement is described whereby the decay of a true electrode potential may be distinguished from the drop due to a resistance when the former requires $>10^{-5}$ sec. per mv. change. Overvoltage decay curves have been obtained for platinised Pt, smooth Pt, Pd, Au, Ag, Zn, Cd, Sb, and Ni, used both as cathodes and anodes. The total measured overvoltage appears as an extremely rapid potential drop which is completed for most of the metals studied in <0·01 sec., followed by a slow decay, probably to the val. of the normal H potential. The initial rapid drop increases with c.d., whilst the residual part of the total overvoltage is nearly const. for a given metal and is independent of the c.d. There is conclusive evidence for the non-existence of a "transfer" or any other kind of resistance at the metal–electrolyte interface. Data are recorded in curves and tables. F. L. U.

Mechanism of hydrogen overvoltage. S. VON NÁRAY-SZABÓ (Z. physikal. Chem., 1938, **181**, 367—374; cf. A., 1937, I, 140, 311).—Previous measurements with Pt and Hg as cathodes have been extended to Ag and Cu, using as electrolytes 2N-HCl and 2N-H_2SO_4. The results agree with Tafel's equation only after the cathode has become saturated with H_2. A discharge mechanism for saturated, and an adsorption mechanism for unsaturated, active

surfaces suffice to explain the behaviour of all the metals studied. F. L. U.

Anode polarisation in dissolution of copper. O. ESSIN and L. ANTROPOV (J. Gen. Chem. Russ., 1937, **7**, 2719—2728).—Equations connecting the polarisation of Cu anodes with the concn. of the electrolyte ($CuSO_4$ in dil. H_2SO_4) and with c.d. are derived. The stable polarisation–c.d. curves suggest that anode polarisation is in this case due to retardation of the process $Cu \rightarrow Cu^{\cdot\cdot}$. R. T.

Mechanism of the hydrogen electrode process I. Catalytic mechanism. J. HORIUTI and G. OKAMOTO. **II. Electrochemical mechanism. The existence of hydrogen molecule ions on the surface of the electrode.** K. HIROTA and J. HORIUTI (Bull. Chem. Soc. Japan, 1938, **13**, 216—227, 228—233; cf. A., 1936, 430, 1347).—I. Additional support is given to the catalytic theory of the liberation of H_2 at a Ni electrode by the actual val. of the electrode current and the observations that the isotopic interchange rate between D_2 and the solution is insensitive to variations in p_H, and that changes in the electrode potential are accompanied by anomalous current surges.

II. The theory of the existence of a $H_2^{\cdot}$ ion at the surface of a Hg electrode is confirmed by oscillograms of the variation of the electrode potential of a dropping Hg cathode. J. W. S.

Electrochemical polarisation produced in the cylindrical mass of litharge. I. T. TIKU (Bull. Chem. Soc. Japan, 1938, **13**, 110—118).—When a d.c. is passed through a paste of PbO and H_2O packed in a glass tube, positive and negative patterns due to electrolytic polarisation are produced at definite positions along the axis. The ratio of the distance of the positive pattern from the negative end of the tube to the length of the tube is independent of the length or diameter of the tube and the terminal voltage, but it varies with the form of PbO used. J. W. S.

Spark electrolysis. P. JOLIBOIS (Ber., 1938, **71**, [*A*], 73—82).—An account of electrolysis with cathode sparks, the composition of the ppts., the formation of acid at the cathode, anodic diffusion, the phenomena of reduction, and the theory of the processes. The bearing of the results on the customary electrolysis is discussed. Consideration is given to anode sparks and their spectrogram. The application to quant. analysis is discussed. H. W.

Auto-complex formation of boric acid. J. E THYGESEN (Z. anorg. Chem., 1938, **237**, 101—112).—Measurements of Λ for H_3BO_3 in H_2O between 0·0279 and 0·602M indicate that univalent tetraborate ions and, to a small extent, bivalent tetraborate ions are present above 0·1M. Estimated vals. of the dissociation and polymerisation consts. of the tetraboric acid are recorded. F. J. G.

Statistical mechanical treatment of the absolute rate of chemical reaction. J. HORIUTI (Bull. Chem. Soc. Japan, 1938, **13**, 210—216).—Mathematical. J. W. S.

Components of a chemical reaction. T. DE DONDER (Bull. Acad. roy. Belg., 1937, [v], **23**, 770—776).—A general equation for a chemical reaction, taking into account the constituents, concn., velocities, affinities, etc., is deduced mathematically. S. C.

Reaction velocity. I, II. T. DE DONDER (Bull. Acad. roy. Belg., 1937, [v], **23**, 936—941; 1938, [v], **24**, 15—18).—I. Mathematical. The velocity of a single reaction in a closed system is discussed.

II. The discussion is extended to multiple reactions. C. R. H.

Affinity, reaction velocity, and power. T. DE DONDER (Bull. Acad. roy. Belg., 1937, [v], **23**, 974—984).—A lecture. The development of the author's theory of affinity is described. (Cf. preceding abstract and A., 1937, I, 568.) C. R. H.

Exchange of hydrogen atoms between pyrrole, indole, and their methyl derivatives and water. I. Pyrrole and water. II. Thiophen and furan and water. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 85—94; 95—98).—I. In dil. D_2O of p_H 2—14 one H of pyrrole, probably that attached to the N, is very rapidly exchanged, but after 10 hr. at 30° no further exchange is observed. At p_H 1—2 further exchange occurs with appreciable velocity, whilst at p_H <1 it is so fast as to be almost unmeasurable. With 99·4% D_2O all five H are replaced by D, and if the distribution coeff. between NH and H_2O is 0·88, that between the CH group of pyrrole and H_2O is 0·70.

II. Thiophen and furan do not exchange their H in acid solution at room temp. Exchange occurs only when they are shaken with acid D_2O at 150° in presence of Pt-black. It is concluded that the electron configuration of pyrrole and the chemical properties of the NH and the N have a controlling influence in determining the exchange in pyrrole. J. W. S.

Spontaneous inflammation of hydrocarbons mixed with oxygen, and its relations with the octane number. M. PESCHARD (Compt. rend., 1938, **206**, 485—487; cf. A., 1929, 147).—Combustion of *n*-C_5H_{12}, *n*-C_7H_{16}, *iso*-C_8H_{18}, *cyclo*hexane, and C_6H_6, at 800—1000° K., has been investigated. Except for C_6H_6, tho lower pressure limit for inflammation, p, obeys the relationship $\log p/T = A/T + B$, in each case, provided the temp. is <920° K. Above 920° K. the character of the inflammation changes, becoming quieter, and the induction period increases from <4 sec. to several hundred sec.; the above relation is not followed. C_6H_6 gives this type of inflammation only, in the temp. range given. No relation is observed between A and the C_8H_{18} no. of the fuel, but the ordinates of the $\log p/T$–$1/T$ curves, at a given temp., increase in the order of the C_8H_{18} nos. A. J. E. W.

Projection of the flame of gaseous mixtures. P. LAFFITTE and A. PARISOT (Compt. rend., 1938, **206**, 603—605).—C_2H_2–, C_3H_8–, and C_4H_{10}–O_2 mixtures have been ignited in a tube closed by a Cellophane membrane 0·04 mm. thick, and joined by the membrane to a second tube open to the air. The flame is "projected" as a luminous region free from explosive in the open tube with a luminescence >

that of the flame arriving at the membrane. Speeds of normal and projected flames have been studied. R. S. B.

Kinetics of the oxidation of ethane. Influence of water, carbon dioxide, and carbon monoxide on the oxidation kinetics and ignition range of ethane. E. A. ANDREEV (J. Phys. Chem. Russ., 1937, **10**, 859—865).—Measurements were made between 590° and 660° and in presence of 6% CO, 5% CO_2, or 3% H_2O. J. J. B.

Region of the two-stage spontaneous ignition of hydrocarbons. A. V. BELOV and M. B. NEUMANN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 333—336).—For various C_5H_{12}–air mixtures the induction periods for the hot and cold flame have been determined at different temp. and pressures. At const. temp., increase of initial pressure reduces the induction period of a cold flame. At 318° and under initial pressures 3·5—3·9 kg. per sq. cm., a cold flame is transformed into a hot one and a two-stage spontaneous explosion occurs. At higher pressures there is no evidence of a cold flame and the explosion occurs in one stage. The results are explained on the basis of two parallel oxidations, one proceeding according to the mechanism of degenerate explosion, the other being connected with the formation of peroxides which decompose when their concns. reach crit. vals. C. R. H.

Ignition of firedamp–air mixtures by compression.—See B., 1938, 340.

Explosive range of mixtures of carbon disulphide, carbon tetrachloride, and air. P. V. POPOV and K. E. BEZZUB (Trans. Sci. Inst. Fertilizers U.S.S.R., 1935, No. 123, 210—214).—The lower ignition limit for CS_2–air mixtures is at 1·7—1·8% CS_2. For commercial CS_2 (79·4% pure) it is 1·19—2·1%. The ignition zones of CS_2–CCl_4 mixtures are shown graphically. CH. ABS. (e)

Decomposition of organic peroxides. E. J. HARRIS and A. C. EGERTON (Nature, 1938, **141**, 472).—In Neumann's equation, $\log p = A + BT^{-1}$, for the decomp. of Et_2O_2 (A., 1937, I, 523), A and B depend on the dimensions of the vessel in which decomp. occurs. Up to the region of the sharp pressure limits the peroxide decomposes unimolecularly with an activation energy of 34 kg.-cal. The effect of foreign gases, *e.g.*, He, on the pressure limits is small. L. S. T.

Decomposition of gaseous trioxymethylene and paraldehyde. R. LE G. BURNETT and R. P. BELL (Trans. Faraday Soc., 1938, **34**, 420—426).—The spontaneous decomp. of trioxymethylene in the range 10—60 mm. at 270° to 345° and in the range 0·1—60 mm. at 312° is a homogeneous reaction of the first order >15 mm. when $\log_e k = 37{\cdot}20—47400/RT$. Below 15 mm. the velocity falls and it is calc. that 30 square terms must contribute to the activation energy. No fall in the velocity of decomp. of paraldehyde (cf. Coffin, A., 1932, 1094) was observed down to 0·14 mm. at 261°, in accordance with the size of the mol. F. R. G.

Thermal polymerisation of styrene. J. W. BREITENBACH (Monatsh., 1938, **71**, 275—292).—A review, and theoretical discussion of the application of kinetic data to the study of the mechanism of polymerisation. H. J. E.

Kinetics of the hypochlorite and hypobromite reaction. A. SKRABAL and R. SKRABAL (Monatsh., 1938, **71**, 251—274; cf. A., 1937, I, 365).—Measurements are recorded for the formation of aq. $NaClO_3$ from aq. NaOCl at 25°. The Foerster time law was verified. The rate of formation of $NaBrO_3$ from NaOBr + NaOH at p_H 6·7—10·8 is approx. of the third order with respect to NaOBr in the more acid solution, but becomes of the second order with increasing p_H. The dissociation const. of HOBr at 25° is approx. 2×10^{-11}. The theory of these reactions is discussed. H. J. E.

Period of induction in the interaction of potassium bromate with stannous chloride. B. N. SEN (Coll. Czech. Chem. Comm., 1938, **10**, 93—96).—The period of induction varies inversely as the square of the concn. of one of the reactants when the other remains const., and diminishes with rise in temp. The absence of any sensible alteration in the period of induction on introducing glass wool into the reacting solutions is evidence for the absence of wall effect. C. R. H.

Oxidation of iodide ion by persulphate ion. V. Rate at low ionic strength. O. M. KNUDSEN and C. V. KING (J. Amer. Chem. Soc., 1938, **60**, 687—691; cf. A., 1931, 802).—The rate of reaction at ionic strengths 0·0006—0·025 has been determined by titrating the liberated I with $Na_2S_2O_3$ and applying corrections as indicated by calibration curves, previously obtained by titration of known, very dil. solutions. The primary salt effect is in agreement with the predictions of the Brönsted theory. E. S. H.

Kinetics of oxidation of gaseous sulphur dioxide in aqueous solutions and poisoning of manganic sulphate by phenol. L. I. KASCHTANOV and V. P. RUISHOV (Izvest. Teplotech. Inst., 1935, No. 7, 37—40).—The velocity of oxidation may be increased by 100% by the presence of $MnSO_4$ in solution. This catalytic activity is completely inhibited by 0·1% of PhOH. Oxidation of SO_2 proceeds in the solution as well as on its surface. CH. ABS. (e)

Hydrolysis of methyl halides. A. E. MOELWYN-HUGHES (Proc. Roy. Soc., 1938, **A, 164**, 295—306).—The energy of activation (Arrhenius const.) falls as the temp. is raised. The inapplicability of the Arrhenius equation is most marked in reactions involving solute and solvent. The effect is ascribed to three causes: (i) the distribution of energy among a no. of oscillators, (ii) electrostatic interaction of the polar mols. of solute and solvent, (iii) frequency of rotation of solute mol. in the solvent atm. G. D. P.

Rate of hydrolysis of methyl di- and trichloroacetate. R. SKRABAL (Monatsh., 1938, **71**, 298—308).—Measurements of the rate of hydrolysis at 25° were made, using the principle of the Landolt reaction, by adding to the ester a deficit of $NaBO_2$ + HBO_2, which serves to isolate the alkaline hydrolysis, $CH_2Cl{\cdot}CO_2Me + OH' = CH_2Cl{\cdot}CO_2' + MeOH$. When the $NaBO_2$ is completely used there is a sudden increase in acidity, due to the rapid hydrolysis

$CH_2Cl{\cdot}CO_2Me + H_2O = CH_2Cl{\cdot}CO_2' + H^{\cdot} + MeOH$. This change is indicated by bromothymol-blue, and the time for it to occur is measured. The approx. hydrolysis consts. for the OH′ and H_2O hydrolysis may be derived. Similar observations for $CCl_3{\cdot}CO_2Me$ are recorded. H. J. E.

Rate of hydrolysis of vinyl ethyl ether. A. ZAHORKA and K. WEIMANN (Monatsh., 1938, **71**, 229—240).—Measurements of the rate of hydrolysis in slightly acid solutions at 25° were made dilatometrically and by titration of the MeCHO formed with N-Na_2SO_3. The rate $\propto$ the p_H of the solution. The mean val. of the hydrolysis const., K_s, was $1{\cdot}73 \times 10^2$. H. J. E.

Kinetic study of the condensation of ω-hydroxyundecoic acid. M. M. DAVIES (Trans. Faraday Soc., 1938, **34**, 410—420).—The kinetics of the condensation of $OH{\cdot}[CH_2]_{10}{\cdot}CO_2H$ (I) in decahydronaphthalene at 189° and also in C_6H_6 at 80°, and in $CHCl_3$ at 69°, when catalysed by p-$C_6H_4Me{\cdot}SO_3H$, have been investigated. The mol. wt. of (I) and the ratio of $OH{\cdot}[CH_2]_{10}{\cdot}\{CO_2{\cdot}[CH_2]_{10}\}_n{\cdot}CO_2H$ to the dilactone of (I) in the product increase with the concn. of (I). The catalysed reaction is unimol. with respect to (I) whilst the uncatalysed reaction is bimol. The results are interpreted on the basis of the co-existence of both cyclic and linear types of association. F. R. G.

Mechanism of double decompositions through reaction in the solid state. C. WAGNER (Z. anorg. Chem., 1938, **236**, 320—338).—In a reaction involving solids of the type $A + B = C + D$, if the layers of products are arranged between the layers of reactants in parallel (as distinct from successively), the progress of the reaction may be represented as the passage of a current through a local cell, such as $A|C|B|D|A$, and its velocity may be calc. Observed results are in qual. or semi-quant. agreement with the theory. F. J. G.

Thermal decomposition of carbonates of importance in metallurgy. J. ŠPLÍCHAL, S. ŠKRAMOVSKÝ, and J. GOLL (Chem. Obzor, 1937, **12**, 181—183, 203—206, 224—230, 252—257; cf. A., 1937, I, 523).—The thermal decomp. of carbonates has been studied, using a stathmographic method (continuous registration of the loss of wt. by a beam of light on photographic paper), which is claimed to be superior to the usual pressure measurements. The decomp. of magnesite, siderite, and dialogite are 2/3 order reactions at temp. below 600°, but above 600° are 1/3 order reactions, as is the decomp. at all temp. of $CaCO_3$, which needs a higher temp. for initial decomp. than the former. The decomp. of carbonates at higher temp. and the evaporation of I are reactions of the 1/3 order. The decomp. of double compounds, *e.g.*, dolomite and ankerite at above 700°, is discontinuous. F. R.

Corrosion of rotating metal discs. A. URMÁNCZY (Z. anorg. Chem., 1938, **235**, 363—368).—When Ag discs are rotated in dil. HNO_3 the rate of corrosion decreases with increasing speed of rotation, and the discs show a spiral pattern of etched lines. A similar pattern is found with Cu but not with Zn. The observations can be interpreted in terms of the accelerating effect of N oxides on the corrosion. F. J. G.

Kinetics of reaction of copper with aqueous ferric chloride. S. A. PLETENEV and S. A. PAVLOV (J. Appl. Chem. Russ., 1937, **10**, 1957—1968).—The reaction between Cu and aq. $FeCl_3$ is represented by $Cu + 2FeCl_3 \rightarrow CuCl_2 + 2FeCl_2$, and is one of the first order. The temp. coeff. is 1·2, suggesting that the velocity of reaction is determined by that of diffusion to and from the Cu surface. The nature of the reaction is unaffected by covering the Cu with a layer of gelatin, but its velocity is lowered, to an extent $\propto$ the thickness of the layer (for small thicknesses). R. T.

Velocity of dissolution of lead in acids. III. G. TEDESCHI (Atti R. Accad. Lincei, 1937, [vi], **26**, 406—409; cf. A., 1938, I, 37).—Addition of neutral salts markedly increases the rate of dissolution of spongy Pb in acids. With HCl, if the ionic strength of the solution remains const., the rate of dissolution decreases as the ratio [KCl]/[HCl] increases, and diffusion becomes the more important factor. O. J. W.

Kinetics of the formation of corrosion centres on metals. E. I. GUROVITSCH (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 1453—1486).—The no. of corrosion centres formed on Fe in I vapour increases with rising temp. and increasing [I] and decreases with increasing humidity. The rate of growth of a corrosion centre increases with time and with the above factors. The rôles of the initial oxide film, adsorption, and humidity on the corrosion process have been investigated. Similar corrosion centres are formed on Al, but visibly separate centres are not formed on Ag, Cu, Pb, or Cd in I vapour; the effect on Sn is intermediate. E. S. H.

Combustion and detonation of solid explosives.—See B., 1938, 461.

Catalytic decomposition of sodium perborate solutions. J. R. LEWIS and F. T. EGGERTSEN (Proc. Utah Acad. Sci., 1935, **12**, 105—106).—A solution containing equiv. quantities of H_3BO_3, H_2O_2, and NaOH decomposes more rapidly than aq. $NaBO_3$ of the same concn. CH. ABS. (*e*)

Rates of oxidation of ethyl disulphide and ethyl mercaptan by bromine. Effect of hydrogen ion. H. A. YOUNG and M. B. YOUNG (J. Amer. Chem. Soc., 1938, **60**, 590—591).—The effect of the initial $[H^+]$ on the initial rate of reaction of Et_2S_2 and Br in CS_2–H_2O is shown by the relation, $k = 0{\cdot}030 + 0{\cdot}043[H^+]^{1/2{\cdot}68}$. As expected, the rates of oxidation of EtSH and Et_2S_2 are very similar, but the H^+ liberated through the CS_2 does not have its full effect. Increasing the H_2O–CS_2 surface per mol. of reactants increases the rate of reaction, as demanded by previous theories. R. S. C.

Oxygen exchange reactions of organic compounds and water. M. COHN and H. C. UREY (J. Amer. Chem. Soc., 1938, **60**, 679—687).—Rates of exchange have been investigated, using H_2O samples containing 0·08—0·75% of ^{18}O. The O of OH and CO_2H (except chloroacetic acids) does not exchange

with H_2O, but exchange occurs between $COMe_2$ or MeCHO and H_2O. With $COMe_2$ the reaction is catalysed by $H^{\cdot}$, OH', and salicylic acid mols., but not by salicylate ions. The catalytic coeffs. for $H^{\cdot}$ and salicylic acid mols. have been determined; the difference between these rates and the rates of enolisation of $COMe_2$ shows that exchange of O does not proceed through the enolic form. E. S. H.

Thermal decomposition of oxalic acid in solution. Decomposition of oxalic acid in aqueous solution at 99·4°. A. DINGLINGER and E. SCHRÖER (Z. physikal. Chem., 1938, **181**, 375—378).—The decomp. of aq. N-$H_2C_2O_4$ at 99·4° is about twice as rapid in a Pt as in a glass vessel (cf. A., 1937, I, 622). The heat of activation is no longer dependent on temp., and the velocity coeff. between 100° and 170° is given by $14{\cdot}7e^{-36300/RT}$. F. L. U.

Application of the Arrhenius formula to the influence of temperature on the velocity of inversion of sucrose in concentrated hydrochloric acid. M. DUBOUX (Helv. Chim. Acta, 1938, **21**, 236—251).—The velocity of inversion of sucrose has been determined at 0° and 25°, when catalysed by HCl alone or in presence of NaCl, $MgCl_2$, and NH_4Cl. For const. [Cl'] $\log k/m$ varies linearly with m, where k is the velocity coeff. and m is the molarity of HCl. The val. of the coeff. A in Arrhenius' formula, $\log k_1/k_2 = A(T_2 - T_1)/T_1T_2$, diminishes with increasing concn. of HCl or chloride. In absence of chloride $A = 5581 - 75m$, and in presence of chloride of molarity m', $A = 5581 - 100m - Sm'$, where $S = 40$ for NaCl, 52 for $MgCl_2$, and 97 for NH_4Cl. C. R. H.

Amine catalysis of the ketonic decomposition of αα-dimethylacetoacetic acid. K. J. PEDERSEN (J. Amer. Chem. Soc., 1938, **60**, 595—601).—The kinetics of reaction have been investigated at 25° and 35° in o-$C_6H_4Cl{\cdot}NH_2$ and NH_2Ph buffer solutions. The velocity coeffs. and consts. A and Q of the Arrhenius equation have been determined. The influence of [$H^{\cdot}$] has been studied. E. S. H.

Acid catalysis in liquid ammonia. II. Ammonolysis of ethyl benzoate. L. L. FELLINGER and L. F. AUDRIETH (J. Amer. Chem. Soc., 1938, **60**, 579—581; cf. A., 1938, I, 204).—Kinetic studies of the reaction in presence of NH_4 salts at 0° and 25° show it to be a pseudo-first order reaction. The catalytic influence of NH_4 salts is in the order: $NH_4OBz > NH_4Cl > NH_4Br > NH_4ClO_4$. In absence of a catalyst the reaction is very slow. E. S. H.

Acid catalysis in non-aqueous solvents. V. Inversion of menthone in chlorobenzene solution. R. P. BELL and E. F. CALDIN (J.C.S., 1938, 382—389; cf. A., 1937, I, 88).—The influence of mono-, di-, and tri-chloroacetic, o-nitrobenzoic, benzoic, and picric acids on the rate of inversion of l-menthone in PhCl at 99·4° has been determined. A relation between the catalytic power in PhCl and the dissociation const. in H_2O has been found for the carboxylic acids, but the catalytic power of picric acid is < that predicted from the relation. The degree of complex formation between menthone and mono-, di-, and tri-chloroacetic, phenylpropiolic, m-nitrobenzoic, benzoic, and acetic acids in PhCl at room temp., determined by cryoscopic measurements and the instantaneous change of rotation on adding the acid, is correlated with the dissociation const. of the acid in H_2O, indicating that the complex formation is a protolytic reaction. E. S. H.

Catalytic decomposition of hydrogen peroxide by colloidal platinum carbonyl. I. SANO (Bull. Chem. Soc. Japan, 1938, **13**, 118—126).—The catalytic decomp. of H_2O_2 by red Pt carbonyl sol (I) (cf. A., 1936, 1170) shows an induction period, after which it obeys a unimol. law, but the catalytic decomp. by colloidal Pt obtained from (I) begins immediately, and shows divergences from the unimol. law. This may be attributed to retardation of the decomp. by O_2 adsorbed on the Pt. J. W. S.

Stationary state of catalysts in heterogeneous reactions. I. C. WAGNER and K. HAUFFE (Z. Elektrochem., 1938, **44**, 172—178).—The concn. of intermediate products adsorbed on catalysts can, in certain circumstances, be determined by electrical conductivity measurements. The combination of CO and CO_2 at 715°, and the decomp. of N_2O at 750°, catalysed by a NiO film, have been examined in this way. For each reaction the concn. of adsorbed O atoms is respectively < and > in presence of O_2 alone at the same partial pressures. The data are discussed with reference to possible mechanisms for the catalysis. C. R. H.

Mechanism of the water-gas reaction with iron as catalyst. E. DOEHLEMANN (Z. Elektrochem., 1938, **44**, 178—183).—The velocity of the reaction $CO_2 + H_2 \rightarrow CO + H_2O$, studied at 910°, $\propto CO_2$ pressure and increases with H_2 pressure, although not proportionally. The concn. of C in the catalyst is > that corresponding with the equilibrium, C (dissolved in γ-Fe) + CO_2 (gas) $\rightleftharpoons$ CO (gas). The data are discussed with reference to mechanisms for the reaction. C. R. H.

Reduction of iron oxides by carbon monoxide in presence of some natural impurities. F. OLMER (Compt. rend., 1938, **206**, 353—355).—Pure Fe_2O_3 catalyses the decomp. of CO at temp. >350°, the action being due to Fe formed by reduction. The catalysis is inhibited by P_2O_5 or Al_2O_3. A. J. E. W.

Preparation of active iron and its application to the semihydrogenation of acetylene derivatives. R. PAUL and G. HILLY (Compt. rend., 1938, **206**, 608—610).—Fe–Al alloy containing 20—30% of Fe was treated with NaOH to dissolve the Al and the black, powdered, pyrophoric Fe obtained used as a catalyst. The Fe partly reduces $PhNO_2$ to $(NPh)_2$ with evolution of heat. The Fe is less effective than Ni prepared under the same conditions, and at 100°/50 atm. CN and NO_2 groups and double linkings in diallylacctonitrile, cinnamic acid, and dihydropyran are not hydrogenated. C:C is converted into C:C. C_2H_2 reacts very little in the cold. At 100—110° and under 40—50 atm. Δ^{α}-heptinene, Δ^{α}-octinene, CPh:CH, α-methoxy-Δ^{β}-octinene, and $CPh{:}C{\cdot}CH_2{\cdot}OMe$ give ethylene derivatives. The speed of hydrogenation is approx. const. and stops abruptly at the

formation of the double linking. Me nonineneoate combines with 2H. R. S. B.

Catalytic investigations on alloys. III. Influence of atomic arrangement of copper-palladium mixed crystals on their properties as catalysts in the decomposition of formic acid vapour. IV. Catalytic hydrogenation of ethylene on copper–silver alloys. G. RIENÄCKER, G. WESSING, and G. TRAUTMANN. (Z. anorg. Chem., 1938, **236**, 252—262, 263—269).—III. The decomp. of HCO_2H on Cu–Pd alloys is of zero order. With increasing % of Cu the energy of activation rises rapidly from its val. for Pd (8 kg.-cal) and between 0 and 62% of Pd has the val. for Cu (23·4 kg.-cal.), so long as the alloys have a disordered structure, but tempered alloys having an ordered structure show a much lower energy of activation.

IV. The hydrogenation of C_2H_4 on Cu–Ag alloys is of the first order. There is a parallelism between the activity of the catalyst and the reciprocal of the grain-size, indicating that the phase-boundaries are the seat of the reaction. The energies of activation on the alloys are $\ll$ on either pure component. F. J. G.

Decomposition of alcohols by mixed catalysts. A. M. RUBINSTEIN (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 1417—1431).—Further experiments on the simultaneous dehydrogenation and dehydration of *iso*amyl alcohol in presence of Al_2O_3–Ni and similar catalysts admixed with other metals (Fe, Co) and oxides (CdO, MnO) confirm the conclusions formerly reached (A., 1937, I, 435). E. S. H.

Energy transformation in the catalytic reaction of fatty oils with hydrogen. C. F. HOLMBOE (Ber., 1938, **71**, [*B*], 532—541).—Hydrogenation of highly purified arachis oil and periodic determinations of the I val. of the product permits the activity const. (α) of the catalyst to be calc. according to $\alpha = 1/t \times \log_e$ max. I val./I val. Electrolytic H_2 must be used to avoid poisoning of the catalyst by compounds of S or C; the temp. is conveniently kept const. by use of such excess of H_2 that the effect of the heat evolved in the change is just counteracted. Similar results can be obtained with a more complex oil, *e.g.*, walnut oil, if it is carefully purified. Diminution of the I val. of an oil by addition of H causes increase of the sp. heat. This is most strongly marked with oils containing highly unsaturated acids, *e.g.*, walnut oil, in which acids with three, four, and five double linkings are present; for complete saturation the addition of 6, 8, or 10 H is required, causing a large increase in the sp. heat of the hydrogenated oil by reason of the additive at. heat of H. H. W.

Catalytic hydrogenation using colloidal rhodium.—See A., 1938, II, 189.

Use of pumice as support for copper–chromium oxide catalysts in dehydrogenations.—See B., 1938, 368.

Methylation of xylene by the Friedel–Crafts reaction.—See A., 1938, II, 177.

Electrolytic separation of deuterium; influence of temperature and current density at various cathode metals. H. F. WALTON and J. H. WOLFENDEN (Trans. Faraday Soc., 1938, **34**, 436—449).—The separation coeff. α for electrolysis of 0·2—0·5N-H_2SO_4, 0·5N-HCl, or 0·5N-HCl + 0·5N-KCl containing 30—50% D_2O between 15° and 95° for c.d. of 0·5 to 1 ma. per sq. cm., decreases with increasing temp. from a val. of 5—7 at room temp. for Ag, Pt, and Ni cathodes, in agreement with Horiuti and Okamoto (A., 1936, 430). For Hg the val. is about 3 and independent of temp., whilst, anomalously, Sn has a val. of 3 rising to 4. The effect of varying the c.d. from 0·03 to 0·6 ma. per sq. cm. is small but definite. The influence on α of α-naphthoquinoline and H_3AsO_3 is recorded. F. R. G.

Behaviour of the palladium cathode in the electrolysis of chromic acid solutions. Electrometric determination of small amounts of SO_4'' in chromic acid. E. MÜLLER (Z. Elektrochem., 1938, **44**, 199—204).—With addition of SO_4'' the potential of the PdH electrode decreases from ~ -1300 mv. to ~ -700 mv. in solutions containing 0·5 g. SO_4 in 100 g. CrO_3. Further increase in $[SO_4'']$ has little effect on the potential. When discharged through a milliammeter, the time taken for the current to fall to a given val., *e.g.*, 5 ma., decreases with increase in $[SO_4'']$. Both of these properties can be applied to the determination of $[SO_4'']$. An explanation of this behaviour is offered. C. R. H.

Chromium-plating in baths containing fluorides.—See B., 1938, 394.

Theory of the electrochemical polyelectrode system and its application to corrosion problems. Correction coefficient $W_p/(W_p + W_s) = R_A/(R_A + R_K)$. W. J. MÜLLER (Korros. u. Metallschutz, 1938, **14**, 63—66).—The equation introduced by Akimov and Tomaschov (A., 1937, I, 245) is identical with that previously derived by Müller. E. S. H.

Theory of dissolution of metals. IV. M. STRAUMANIS (Korros. u. Metallschutz, 1938, **14**, 67—77; cf. A., 1937, I, 418).—The differences in the viewpoints of Straumanis and W. J. Müller are enumerated and discussed. E. S. H.

Potential of metals which enter solution anodically or as local-current anodes. W. J. MÜLLER (Korros. u. Metallschutz, 1938, **14**, 77—80).—A reply to Straumanis (cf. preceding abstract). E. S. H.

Theory of dissolution of metals. V. M. STRAUMANIS (Korros. u. Metallschutz, 1938, **14**, 81—83; cf. preceding abstracts).—Polemical. E. S. H.

Distribution of current density in electrolysis of copper sulphate.—See B., 1938, 393.

Electroplating copper from ammoniacal solutions.—See B., 1938, 394.

Cadmium-plating.—See B., 1938, 394.

Electrolytic colouring [of metals] by means of molybdenum sesquioxide.—See B., 1938, 395.

Electrolytic polishing of aluminium.—See B., 1938, 394.

Reaction products and mechanism in the electrolytic reduction of ethyl iodide.—See A., 1938, II, 167.

Electrolysis of 2 : 4-dimethylbenzoic acid in presence of its sodium salt in methyl alcohol.—See A., 1938, II, 189.

Electrolysis without electrodes. A. M. SISOEV (Ukrain. Chem. J., 1937, **12**, 516—524).—Liberation of I during a spark discharge over aq. KI is ascribed to the action of the products of sparking (O_3, H_2O_2, oxides of N), and not to the action of electrons entering the solution. I is liberated at both the cathode and the anode when both electrodes are out of the solution, and only at the anode when only one of them is immersed in the solution. R. T.

Synthesis of nitric oxide in the torch discharge. K. N. MOTSCHALOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 329—332).—The torch discharge, wherein high frequency rate and a lower vol. density of energy than in the arc discharge are combined, has been used for the synthesis of NO. Under the experimental conditions, the energetic yield increases with time to 45·6 g. of HNO_3 per kw.-hr. after 1 min., but simultaneous reduction of the NO formed causes a subsequent decrease in energetic yield. The energetic yield is considerably reduced by reduction of pressure. C. R. H.

Oxidation of platinum in air and in the glow discharge. A. GÜNTHER-SCHULZE and H. BETZ (Z. Elektrochem., 1938, **44**, 253—255).—When Pt is used as cathode for a glow discharge in O_2 it becomes covered with an oxide layer if the p.d. is <1500 v.; if >1500 v. the layer is destroyed as rapidly as it is formed. Gaseous Pt, produced by the bombardment, combines violently at room temp. with active O formed by the discharge and gives probably PtO_2. Pt lying in air is also covered by an oxide layer. T. H. G.

Production of "reaction layers" on metals by means of the corona discharge. A. GÜNTHER-SCHULZE and H. BETZ (Z. Elektrochem., 1938, **44**, 248—253).—Corona discharge in air results in the formation of a layer of $AgNO_3$ on Ag wire when the R.H. is $>95\%$. Reaction is purely chemical. The rate of increase of thickness of the layer $\propto$ (duration of discharge)$^{\frac{1}{2}}$. When the R.H. is $<40\%$ reaction is purely electrochemical and Ag_2O and perhaps Ag nitride are formed, the rate of growth being $\propto$ duration. Between 40% and 95% R.H. the results are intermediate. With pure dry N_2 the rate of reaction $\propto$ time and also (approx.) with Cu and Fe wires in air. W appears to be unaffected. T. H. G.

Films formed on electrodes during activation of oxide-coated cathodes. L. B. HEADRICK and E. A. LEDERER (Physical Rev., 1936, [ii], **50**, 1094).—The deactivation of oxide-coated cathodes observed in electron tubes when an electrode close to the cathode is bombarded by electrons is due to decomp., by electrons of 7—25 v., of a film formed on the side of the electrode exposed to the cathode. The films are formed during activation of the oxide-coated cathode, and are attributed to the formation of polymerised C–O compounds by surface reaction. The deactivation is attributed to the O liberated by electron bombardment. The films may have a high resistance. L. S. T.

Photo-reactions of nitrites with iodine. I, II. G. G. DURRANT, R. O. GRIFFITH, and A. MCKEOWN (Trans. Faraday Soc., 1938, **34**, 389—400, 400—410).—I. Reaction between $NaNO_2$ and I_2 in PO_4''' buffers at λ 436, 546, and 579 mμ. yields 0·005 to 0·1 I_2 per quantum (γ). γ is independent of rate of absorption of energy, initial $[I_2]$, and, within limits, of p_H but depends on λ, t, total ionic strength I, $[I']$, and $[NO_2']$. For const. t and I, $\gamma(A[I']^2/[NO_2'] + 1)(K_3' + [I']) = K_3'(U_1 + V_1[NO_2']) + [I'](U_2 + V_2[NO_2'])$, where A is a const. equal in val. to that in the thermal reaction (A., 1936, 1073); $K_3' = K_3\alpha_1/\alpha_2$ where K_3 is the tri-iodide equilibrium const., α_1 and α_2 the mol. extinction coeffs. of I_2 and I_3', U_1, U_2, V_1, and V_2 are consts. dependent on λ.

II. A mechanism proposed in terms of light absorption in liquid media leads to the above equation. γ in presence of C_2O_4'' at 25° and 35° are recorded and are in accordance with the theory. F. R. G.

Colloidal silver and the latent image theory. M. SAVOSTJANOVA (Sci. ind. phot., 1935, [ii], **6**, 285—286).—Experiments with films of AgCl or AgBr fused between two glass plates show that the Ag particles formed by the action of light are <30 mμ. in diameter. The Ag is shown ultramicroscopically to be colloidal. CH. ABS. (*e*)

Photochemistry of colloidal silver bromide. F. URBACH (Sci. ind. Phot., 1935, [ii], **6**, 288).—If quinol is added to a negatively charged AgBr sol and the latter then exposed to an arc light, the colour is intensified rapidly at first and then more slowly. If the arc is cut off, the coloration regresses, rapidly at first and then more slowly. A yellow coloration, due to colloidal Ag dispersed in H_2O, persists. Addition of gelatin stabilises the coloration produced by photolysis against spontaneous decolorisation. CH. ABS. (*e*)

Theory of the photolysis of silver bromide and the photographic latent image. R. W. GURNEY and N. F. MOTT (Proc. Roy. Soc., 1938, **A**, **164**, 151—167).—The processes taking place during the exposure and development of a photographic emulsion are discussed in terms of quantum mechanics. The formation of specks of metallic Ag from atoms of Ag produced by the light is described and the ideas employed account qualitatively for the variation of developed density with temp., and, for a given exposure, with the intensity of light. The Herschel effect and sensitisation by dyes are briefly discussed. G. D. P.

Disintegration processes by cosmic rays in [photographic] plates impregnated with samarium. H. J. TAYLOR, D. FRASER, and V. D. DABHOLKAR (Nature, 1938, **141**, 472—473; cf. A., 1937, I, 594).—The presence of "stars" and "clusters" of tracks, apparently due to protons, on plates impregnated with a Sm salt, and exposed to cosmic rays at a height in Kashmir equiv. to 8000 ft. above sea-level, is described. The clusters appear to be associ-

ated with the presence of Ag or Br. Untreated plates, and plates at Bombay, show practically no tracks. L. S. T.

Cosmic-ray tracks in photographic emulsions. T. R. WILKINS (Physical Rev., 1936, [ii], **50**, 1099).—Further tracks due to high-energy particles have been found in plates used in the stratosphere flight of Explorer II. Cosmic-ray short-branch tracks indicate disintegration without capture of the high-energy particle. L. S. T.

Influence of surface-active anions and cations on silver halide sols and photographic emulsions. I. A. LOTTERMOSER and R. STEUDEL (Kolloid-Z., 1938, **82**, 319—335).—The prep. of pure dodecylpyridinium bromide (DopyBr) is described. The sign of the charge on AgI hydrosols in presence of DopyBr or Na dodecylsulphate ($NaDoSO_4$) is completely determined by the surface-active ion, irrespective of excess of $Ag^{\cdot}$ or I'. The sensitiveness to light of AgI sols containing excess of $Ag^{\cdot}$ vanishes in presence of $Dopy^{\cdot}$ or $DoSO_4'$, whence it is inferred that an acceptor is effective only when actually present in the surface. The capacity of AgBr for development is strongly influenced by surface-active ions; *e.g.*, unilluminated AgBr rendered positive with $Dopy^{\cdot}$ is immediately reduced by anionic developers such as quinol. The development of photographic emulsions by quinol, pyrocatechol, and glycine developers is greatly accelerated in presence of $Dopy^{\cdot}$, the effect decreasing in the order given. F. L. U.

Polymerisation of ethylene and acetylene photosensitised by ethyl iodide. G. G. JORIS and J. C. JUNGERS (Bull. Soc. chim. Belg., 1938, **47**, 135—147).—Polymerisation of C_2H_4 or C_2H_2 is sensitised by the photolysis of EtI in presence of Hg. The yield increases with rising temp. and $[C_2H_4]$, and decreases with increasing [EtI] and light intensity. A mechanism of reaction involving the formation of Et radicals is discussed. E. S. H.

Photochemical polymerisation of methyl methacrylate vapour. H. W. MELVILLE (Proc. Roy. Soc., 1937, **A**, **163**, 511—542).—The technique of gas kinetics is used to follow the reaction; polymerisation, to a white solid, occurs nearly quantitatively if the radiation is absorbed by the CO_2Me group ($\lambda > 2200$ A.). Shorter $\lambda\lambda$ decompose the mol. After irradiation the polymeride grows in the dark at a rate which $\propto$ the area of the tube illuminated. This growth is stopped by H atoms and I_2 mols. but is unaffected by O_2, C_2H_4, and C_2H_2. Polymerisation is also initiated by H atoms, and takes place at a faster rate than the normal reaction. The mechanism of growth is discussed. G. D. P.

Kinetics of tyrosine destruction and dopa [*l*-3 : 4-dihydroxyphenylalanine] formation by ultra-violet rays. L. E. ARNOW (J. Physical Chem., 1938, **42**, 415—418; cf. A., 1937, II, 419).—The reaction is of the first order. F. L. U.

Photochemical transformations of hydrogenated naphthalene derivatives. Mechanism of photopolymerisation of acetylene.—See A., 1938, II, 179.

Photosensitisation by titanium dioxide. C. F. GOODEVE and J. A. KITCHENER (Trans. Faraday Soc., 1938, **34**, 570—579; cf. A., 1937, I, 110).—Chlorazol-sky-blue FF adsorbed on mordanted TiO_2 shows marked fading when exposed for a short time to a Hg arc lamp, the sensitivity extending from λ 720 mμ. to the far ultra-violet. The quantum efficiency rises rapidly with decrease of λ from the extreme red to the region where the dye absorbs strongly, and again rises at the λ corresponding with the threshold of absorption of the TiO_2. At λ 365 mμ. the rate of bleaching, after an initial slow period, is determined by the concn. of "vulnerable" dye mols., and decreases slightly with rise of temp. F. L. U.

Photodichroism of light-sensitive dye films as a function of the illumination. G. UNGAR (Z. physikal. Chem., 1938, **B**, **38**, 427—440).—A mathematical treatment of the Weigert effect. H. J. E.

Effect of temperature on the photochemical bleaching of visual purple. H. J. A. DARTNALL, C. F. GOODEVE, and R. J. LYTHGOE (Proc. Roy. Soc. 1938, **A**, **164**, 216—230).—The quantum efficiency of the bleaching process is approx. unity and is independent of temp. in the range 20—60° and of p_H from 6·8 to 9·2. The results are in agreement with a theory previously developed (cf. A., 1936, 1480). G. D. P.

Decomposition of ammonia by slow electrons. G. M. SCHWAB (Z. anorg. Chem., 1938, **236**, 296—305).—NH_3 is decomposed by slow electrons, the min. accelerating potential being $9\pm1·4$ v., and every collision being effective. F. J. G.

Cannizzaro's reaction in heavy water. H. FREDENHAGEN and K. F. BONHOEFFER (Z. physikal. Chem., 1938, **181**, 379—391; cf. A., 1934, 281).—Examination of the H_2O produced by burning $CH_2Ph{\cdot}OH$ and MeOH obtained by the action of KOH dissolved in D_2O on PhCHO and CH_2O shows that no exchange with the H of the solvent occurs, but only the transference of a H atom from one mol. to another. Similarly, no non-hydroxylic D is contained in the $OH{\cdot}CH_2{\cdot}CO_2H$ formed by acting on $(CHO)_2$ with CaO and D_2O. The results are best in accord with the mechanism proposed by Meerwein and Schmidt (A., 1925, i, 1239). F. L. U.

Transformations of hexoses in heavy water. H. FREDENHAGEN and K. F. BONHOEFFER (Z. physikal. Chem., 1938, **181**, 392—405).—During the mutarotation of α-*d*-glucose in 99·6% D_2O no exchange occurs except with the hydroxylic H, a D-free product being obtained by dissolution in a little H_2O and subsequent evaporation of solvent. Transformation of glucose into fructose by the action of CaO dissolved in D_2O takes place at room temp. without the introduction of D, whilst at 40° the fructose formed contains 1 D atom attached to C. The latter reaction is regarded as a keto–enol change, and the former as a modified type of Cannizzaro's reaction (preceding abstract). Both the alkali-catalysed conversion of tetramethylglucose into tetramethylmannose and the formation of glucose 6-phosphate from fructose 6-phosphate by the fermentative action of muscle extract involve the exchange of 1 non-hydroxylic H. F. L. U.

Exchange reactions of acetic acid and acetate ions in heavy water. See A., 1938, II, 169.

Explosion of chloroform with alkali metals. T. L. DAVIS and J. O. MCLEAN (J. Amer. Chem. Soc., 1938, **60**, 720—722).—When Na or K and $CHCl_3$ are exploded by shock the products contain $COCl_2$, H_2, HCl, and $C_6H_6Cl_6$. The mechanism of reaction is discussed. E. S. H.

Ortho-salts of oxyacids. E. ZINTL and W. MOROWIETZ (Z. anorg. Chem., 1938, **236**, 372—410).—Various oxides and salts were heated with varying proportions of Na_2O, and the products investigated by means of *X*-rays. In this way the following *compounds* were found to be formed as the highest ortho-salts: Na_3AgO_2, Na_4BeO_3, Na_3BO_3, Na_5AlO_4, Na_4SnO_4, Na_4PbO_4, Na_4PbO_4,Na_2O, Na_3NO_3, Na_3NO_4, Na_2SO_4,$0{\cdot}5Na_2O$, Na_2SeO_4,$0{\cdot}5Na_2O$, Na_6TeO_6, and Na_5IO_6. The existence of Na_4SiO_4 and $Na_6Si_2O_7$ (A., 1930, 1005) was confirmed. MgO, Na_2CO_3, and Na_3PO_4 do not combine with Na_2O. HCO_2Na, NaOAc, and $NaClO_4$ are decomposed. The max. co-ordination nos. found in this way are discussed in the light of the electrostatic theory. F. J. G.

Crystallisation of potassium chloride from melts. A. M. KUBLITZKI and A. S. TOPORETZ (J. Phys. Chem. Russ., 1937, **10**, 882).—Comments on Zechnovitzer's paper (A., 1937, I, 627). J. J. B.

Absorption of carbon monoxide in ammoniacal copper carbonate solutions on passing carbon monoxide or mixtures of carbon monoxide and nitrogen through them. K. LESCHEWSKI, H. G. TOLKMITT, and H. MÖLLER (Z. anorg. Chem.; 1938, **235**, 369—384; cf. A., 1935, 1332).—When CO or CO + N_2 passes through solutions of Cu^{I} in aq. NH_3 and $(NH_4)_2CO_3$ at room temp. the % of CO absorbed is a max. when the gas contains 50—70% CO. After absorption two slow reactions take place in the solution, viz., disproportionation of $Cu^{\cdot}$ to $Cu^{\cdot\cdot}$ and Cu, and reduction of Cu^{II} to Cu^{I} by CO, the former being the more rapid. If the solution contains equiv. amounts of Cu^{I} and Cu^{II} the absorbed CO is oxidised quantitatively without separation of Cu. F. J. G.

Absorption of oxygen or carbon monoxide and oxygen in ammoniacal copper carbonate solutions on passing oxygen, air, or mixtures of carbon monoxide and air through them. K. LESCHEWSKI, H. G. TOLKMITT, and H. MÖLLER (Z. anorg. Chem., 1938, **235**, 385—406; cf. preceding abstract).—The O_2 is absorbed relatively rapidly and, if sufficient Cu^{I} is present, completely. The rate of absorption increases with concn. and is greatest when there is excess of either Cu^{I} or O_2. The absorption of CO from its mixtures with O_2 proceeds in the same way as from mixtures with N_2, but the equilibrium is not set up as the bound CO becomes converted into $(NH_4)_2CO_3$. CO can therefore be continuously absorbed from mixtures with air by ammoniacal solutions containing Cu^{I} and Cu^{II} in excess. F. J. G.

Reactions in fused pyridine hydrochloride. A. LONG and L. F. AUDRIETH (Trans. Illinois State Acad. Sci., 1935, **28**, No. 2, 121—122).—Certain metallic oxides (*e.g.*, CuO, BaO, MgO, PbO, Fe_2O_3) dissolve in fused C_5H_5N,HCl, forming chlorides, C_5H_5N, and H_2O. Oxides of W, Ta, Th, Ti, and Sn do not react. Double metallo-C_5H_5N salts are formed in certain cases. Active metals dissolve in fused C_5H_5N,HCl, displacing H_2. Good cathodic deposits were obtained from these conducting melts only for metals such as As, Sb, Bi, Hg, and Co.

CH. ABS. (*e*)

Composition of some gold and tungsten cyanides. M. M. RAINES (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 339—340).—The compound formed by interaction of HCN with a solution of $HAuCl_4$ is $H[Au(CN)_4],3H_2O$. $K_4[W(CN)_8],2H_2O$ is formed by interaction of HCN with a solution of $K_3W_2Cl_9$, followed by neutralisation and pptn. with EtOH. C. R. H.

Compounds of dyes of the triphenylmethane series with metallic salts.—See A., 1938, II, 185.

Hydrolysis of beryllium and aluminium chloroacetates. M. J. ŠIRŮČEK (Coll. Czech. Chem. Comm., 1938, **10**, 117—128).—The acidities of the solutions can be expressed by the relations: $p_H = -0{\cdot}87 \log [Be^{\cdot\cdot}] + 1{\cdot}85 = -0{\cdot}54 \log [Al^{\cdot\cdot\cdot}] + 2{\cdot}65$ for trichloroacetates; $p_H = -0{\cdot}55 \log [Be^{\cdot\cdot}] + 2{\cdot}52 = -0{\cdot}54 \log [Al^{\cdot\cdot\cdot}] + 2{\cdot}65$ for dichloroacetates; $p_H = -0{\cdot}45 \log [Be^{\cdot\cdot}] + 3{\cdot}05 = -0{\cdot}40 \log [Al^{\cdot\cdot\cdot}] + 2{\cdot}98$ for chloroacetates. The vals. of $[H^{\cdot}]/[Be^{\cdot\cdot}]$ and $[H^{\cdot}]/[Al^{\cdot\cdot\cdot}]$ increase with dilution in the case of the chloro- and dichloro-acetates, but show a min. at 0·25M in the case of the trichloroacetates. C. R. H.

Hydration and dehydration of magnesium sulphate and its hydrates. K. H. IDE (Z. anorg. Chem., 1938, **235**, 305—323).—$MgSO_4$ on exposure to moist air forms first $MgSO_4,6H_2O$ and subsequently $MgSO_4,7H_2O$, whereas $MgSO_4,H_2O$ forms $MgSO_4,7H_2O$ directly. The intermediate formation of lower hydrates cannot be detected by means of *X*-rays. In the dehydration of $MgSO_4,7H_2O$ over P_2O_5, $MgSO_4,6H_2O$ is always formed as an intermediate product, and in some cases lower hydrates also. The final product is $MgSO_4,H_2O$ in a very finely-divided (amorphous?) condition. F. J. G.

Constitution of Streng's salt. R. CHARONNAT (Bull. Soc. chim., 1938, [v], **5**, 205—207).—Since, on electrolysis of its solutions, Mg and U migrate to the anode and Na to the cathode, the formula $Mg\{[UO_2(OAc)_3]_3\}Na$ is proposed for the salt. C. R. H.

Hydrothermal reactions. I. Formation of magnesium hydrosilicates. W. JANDER and J. WUHRER (Z. anorg. Chem., 1938, **235**, 273—294).—Serpentine and talc have been synthesised from MgO, SiO_2, and H_2O at 350° and 163 atm. They are also formed under these conditions from $MgSiO_3$ and H_2O or acid or alkaline solutions, and from Mg_2SiO_4 and acid solutions. The mechanisms of the reactions are discussed. F. J. G.

Calcium trimetaphosphate. A. BOULLÉ (Compt. rend., 1938, **206**, 517—518; cf. A., 1936, 809).—The *salt* $Ca_3[(PO_3)_3]_2,9H_2O$ (I), is formed by addition of aq. $CaCl_2$ solution to an aq. suspension of $Ag_3(PO_3)_3$

at 0°; the product is filtered and the filtrate crystallised, or (I) is pptd. by addition of EtOH. (I) loses $6H_2O$ at 110° and decomposes at higher temp. A. J. E. W.

Action of saturated steam on dicalcium ferrite and on tetracalcium aluminoferrite. D. T. MATHER and T. THORVALDSON (Canad. J. Res., 1937, **15**, B, 331—339).—The products of the action of saturated steam free from CO_2 at 100—300°, followed in all cases by drying in a vac. over CaO, have been studied by determining *X*-ray patterns, H_2O content, and optical properties. CaO in steam at 150—300° forms $Ca(OH)_2$; Al_2O_3 gives Al_2O_3,H_2O, and the same hydrate after first dehydrating at <920°. $Fe_2O_3,1{\cdot}12H_2O$ gives in steam at 100—170° a product with $H_2O : Fe_2O_3$ (mol. ratio) = 0·020, and the same crystal structure as hæmatite. $3CaO,Al_2O_3$ gives at 150—300° in steam $3CaO,Al_2O_3,6H_2O$. $2CaO,Fe_2O_3$ gives at 100—300° $Ca(OH)_2$ and Fe_2O_3 (hæmatite) according to the reactions, at 150°, $2CaO,Fe_2O_3 + 2H_2O \rightarrow 2CaO,Fe_2O_3,2H_2O \rightarrow Ca(OH)_2 + CaO,Fe_2O_3,H_2O \rightarrow 2Ca(OH)_2 + Fe_2O_3$, of which the third is slow compared with the others. $4CaO,Al_2O_3,Fe_2O_3$ (I) gives the reaction (I) + $7H_2O$ = $3CaO,Al_2O_3,6H_2O$ (II) + $Ca(OH)_2$ + Fe_2O_3 in steam at 100—300°. (II) and CaO,Fe_2O_3,H_2O are first formed rapidly, and the latter then decomposes slowly into $Ca(OH)_2$ + Fe_2O_3. R. S. B.

Fluorescence of double salts of calcium phosphate. J. GLASSER and G. R. FONDA (J. Amer. Chem. Soc., 1938, **60**, 722).—Products exhibiting fluorescence in ultra-violet light, similar to that shown by ox teeth, are obtained by co-pptn. of a Ca salt with a mixture of Na_2HPO_4 and Na tartrate, succinate, or lactate, and heating at 400° in air. E. S. H.

Hydrolytic precipitation of cadmium selenide from selenosulphate solutions. E. C. PITZER and N. E. GORDON (Ind. Eng. Chem. [Anal.], 1938, **10**, 68—69).—The effect of temp. and acidity on pptn., the effect of speed of pptn. on composition, and the effect of light on the colour of the ppt. have been studied for the reaction between $CdSO_4$ and Na_2SSeO_3 to form CdSe. For the determination of Se in CdSe treatment with aqua regia leads to low results. Digestion with NaOH + H_2O_2 is preferable as a means of effecting dissolution. L. S. T.

Phosphorescent zinc sulphide. W. H. BYLER (J. Amer. Chem. Soc., 1938, **60**, 632—639).—The production of ZnS with reproducible phosphorescence promoted by Cu is described. The rate of decay of phosphorescence and the acceleration due to the presence of Ni have been measured. Methods for measuring fluorescence, fluorescence growth rate, and α-particle response have also been developed. The decay of phosphorescence after a few sec. corresponds with a series of second-order reactions. The total initial intensity of phosphorescence is greatest after a medium period of excitation. The influence of temp. on rate of decay has been studied at 30° and 45°, and the activation energies for the several processes of decay have been calc.; some of the activation energies are negative. A theory of phosphorescence is outlined, and discussed in relation to composition and hoat-treatment of tho products. E. S. H.

Action of ammonium hydroxide on mercurous chloride. H. R. FRECHE and M. C. SNEED (J. Amer. Chem. Soc., 1938, **60**, 518—524).—The composition of the product depends on [NH_4OH] and the duration of reaction. With dil. NH_3 the end product is a mixture of $HgNH_2Cl$ and Hg; with conc. NH_3 the product also contains $HgCl_2,2NH_3$. E. S. H.

Action of white phosphorus on mercury salts. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 198—200).—Attempts to prepare phosphides by interaction of white P, dissolved in CS_2, and various Hg salts were unsuccessful. HgI, suspended in CS_2, gave yellow Hg_2PI_2, but in aq. solution a brown, easily hydrolysed compound of indefinite composition was formed. C. R. H.

Action of cyanogen on mercuric oxide. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 200).—C_2N_2 does not react with HgO, although at 100° there is some adsorption. C. R. H.

Organic reactions with dihydroxyfluoboric acid.—See A., 1938, II, 177.

Preparation of aluminium oxide for polishing metallographic sections. A. I. SAMOCHOTZKI (Zavod. Lab., 1937, **6**, 1283).—Al is immersed in 10% $HgCl_2$ for 10 min., and then in boiling H_2O for 24 hr. Very fine-grained Al_2O_3, suitable for polishing metal surfaces, is thus obtained. R. T.

Precipitation of rare earths and thorium with magnesium hydrogen sulphite. G. P. ALEXANDROV and J. P. GOCHTSCHTEIN (Redk. Met., 1935, **4**, No. 6, 27—31).—Pptn. of Th and rare earths with $Mg(HSO_3)_2$ from sulphate and chloride solutions led to recoveries of 96—100 and 80—100%, respectively. CH. ABS. (*e*)

Ferro- and ferri-cyanides of the rare earths. W. PRANDTL and S. MOHR (Z. anorg. Chem., 1938, **236**, 243—251; **237**, 160).—By the action of $Na_4Fe(CN)_6$ or $K_4Fe(CN)_6$ on an acid solution of a rare-earth salt the following *alkali–rare earth ferrocyanides* are formed: $NaLa[Fe(CN)_6],10H_2O$, $NaPr[Fe(CN)_6],8H_2O$, $NaNd[Fe(CN)_6],8H_2O$, $NaSm[Fe(CN)_6],6H_2O$, $NaGd[Fe(CN)_6],7H_2O$, $NaDy[Fe(CN)_6],6H_2O$, $NaEr[Fe(CN)_6],6H_2O$, $NaY[Fe(CN)_6],5H_2O$, $KLa[Fe(CN)_6],4H_2O$, $KPr[Fe(CN)_6],4H_2O$, $KNd[Fe(CN)_6],4H_2O$, $KSm[Fe(CN)_6],4H_2O$, $KGd[Fe(CN)_6],5H_2O$, $KDy[Fe(CN)_6],8H_2O$, $KEr[Fe(CN)_6],4H_2O$, $KY[Fe(CN)_6],8H_2O$. By neutralisation of $H_4Fe(CN)_6$ with rare-earth hydroxides *basic ferrocyanides* are obtained, viz., $LaOH[LaFe(CN)_6]_2,18H_2O$, $PrOH[PrFe(CN)_6]_2,15H_2O$, $NdOH[NdFe(CN)_6]_2,18H_2O$, $SmOH[SmFe(CN)_6]_2,15H_2O$, $GdOH[GdFe(CN)_6]_2,15H_2O$, $DyOH[DyFe(CN)_6]_2,15H_2O$, $ErOH[ErFe(CN)_6]_2,14H_2O$, $YOH[YFe(CN)_6]_2,18H_2O$. The following *ferricyanides* are obtained by double decomp.: $LaFe(CN)_6,4{\cdot}5H_2O$, $PrFe(CN)_6,3H_2O$, $NdFe(CN)_6,4H_2O$, $SmFe(CN)_6,4H_2O$, $GdFe(CN)_6,4H_2O$,

$DyFe(CN)_6,4{\cdot}5H_2O$, $ErFe(CN)_6,4H_2O$, $YFe(CN)_6,4H_2O$. All these are obtained as cryst. ppts., the alkali ferrocyanides being the least and the ferricyanides the most sol. Their solubilities in 0·1N-HCl or in H_2O have been determined and the possibility of separating the rare earths by fractional pptn. of these salts is discussed. F. J. G.

Thallous borates and the structure of the boric acids. A. FERRARI and Z. CICCIOLI (Gazzetta, 1938, **68**, 21—28).—The Tl^I borates described by Buchtala (A., 1914, ii, 135) have been prepared and some of their formulæ corr. All these borates contain an even no. of B atoms, and 1 mol. H_2O for every 2 B. Electronic structures for the boric acids are proposed. O. J. W.

Purification of graphite for spectrochemical analysis. A. H. STAUD and A. E. RUEHLE (Ind. Eng. Chem. [Anal.], 1938, **10**, 59).—The described treatment with H_2SO_4 removes many metallic impurities and is more effective than washing with HNO_3, HCl, or aqua regia. Treatment with HF failed to remove Si. L. S. T.

Reaction of silicon fluoride and sodium silicofluoride with beryllium oxide. A. V. NOVOSELOVA, O. I. VOROBIEVA, and N. D. NAGORSKAJA (J. Gen. Chem. Russ., 1937, **7**, 2789—2793).—SiF_4 reacts with BeO at 800° in presence, but not in absence, of NaF, to give Na_2BeF_4 (I). 4 : 1-BeO–Na_2SiF_6 mixtures at 700° give (I) in practically theoretical yield. R. T.

Titanium. VIII. Chlorination of titaniferous substances with a mixture of chlorine and carbon monoxide. A. V. PAMFILOV and M. G. SCHICHER. **IX. Structure of titanium dioxide precipitates.** A. V. PAMFILOV and E. G. IVANTSCHEVA (J. Gen. Chem. Russ., 1937, **7**, 2760—2766, 2774—2778).—VIII. The velocity coeffs. of the reaction $TiO_2 + 2Cl_2 + 2CO \rightarrow TiCl_4 + 2CO_2$ have been calc., for the range 500—1500°; it is shown, on thermodynamic grounds, that complete conversion of TiO_2 into $TiCl_4$ is possible at about 1000°. Approx. 50% yields of $TiCl_4$ were obtained from sphene and titanomagnetite concentrates at 1050°, the order of chlorination of the constituents being CaO, Fe_2O_3, TiO_2, and SiO_2.

IX. Commercial metatitanic acid and TiO_2 and the product of hydrolysis of $Ti(SO_4)_2$ have the anathase structure, modified by heating at 1000° to that of rutile. R. T.

Preparation of pellets of radioactive lead. J. E. RICCI and M. BURTON (J. Amer. Chem. Soc., 1938, **60**, 727).—The prep. from $Pb(NO_3)_2$ and crushed Rn tubes involves purification, pptn. as oxalate, and reduction with KCN. E. S. H.

Thorium tellurides and phosphides. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 197—198).—Interaction of solutions of $Th(SO_4)_2$ and Na_2TeO_4 gives white, gelatinous $TeO_4,ThO,8H_2O$, which loses $4H_2O$ at 200°, and decomposes to TeO_2, ThO_2, and O_2 on calcination. Attempts to prepare Th_3P_4 by heating Th with white P or by treating a solution of $Th(SO_4)_2$ with PH_3 were unsuccessful. C. R. H.

Action of nitrogen dioxide on nitrogen sulphide. A. MEUWSON and S. KRÜGER (Z. anorg. Chem., 1938, **236**, 221—224).—When NO_2 diluted with N_2 reacts with N_4S_4 in CCl_4 the product, formerly supposed to be NSO_4, is $N_2S_2O_9$. F. J. G.

Onium salts as acids. Reactions of ammonium chloride at higher temperatures. M. T. SCHMIDT and L. F. AUDRIETH (Trans. Illinois State Acad. Sci., 1935, **28**, No. 2, 133—134).—Many oxides (*e.g.*, rare-earth oxides, Fe_2O_3, MgO, MnO_2, Sb_2O_3, etc.) react completely when heated with NH_4Cl, giving chlorides. CaO and BaO react slowly, and NiO, CuO, and V_2O_5 give products of indefinite composition. ZnO gives $ZnCl_2,NH_3$, which may be separated by distillation at red heat. Oxides of U give UO_2Cl_2. $CaCO_3$, $MgCO_3$, $MnCO_3$, and $ZnCO_3$ behave like the corresponding oxides. In preparing anhyd. chlorides by the above method, excess of NH_4Cl may be removed by sublimation at 300—320°. NH_4Cl vapour is more active than dry HCl. When heated at 200—300° in contact with air, most of the common metals and alloys are rapidly corroded by NH_4Cl. Ni is most resistant in vac. Volatile chlorides, *e.g.*, $FeCl_3$, may be separated from siliceous materials by vac. distillation. CH. ABS. (*e*)

Thermal decomposition of ammonium perchlorate. I. Influence of temperature on the nature of the products formed during oxidation of ammonia. II. Experimental. M. DODÉ (Bull. Soc. chim., 1938, [v], **5**, 170—176, 176—183).—I. At temp. < approx. 380° decomp. mainly accords with the equation $4NH_4ClO_4 = 2Cl_2 + 3O_2 + 8H_2O + 2N_2O$, but at higher temp. NO is formed and unites with Cl_2 and O_2. The decomp. is compared with that of NH_4NO_3 and NH_4MnO_4 and it is suggested that the products of all NH_4 salts of acids sufficiently oxygenated are similarly dependent on the temp. of decomp.

II. Details of the decomp. experiments and the analytical methods are given. C. R. H.

Ozone reaction during the oxidation of phosphorus. K. FISCHBECK and H. EICH (Ber., 1938, **71**, [*B*], 520—532).—Study of the oxidation of solid yellow P is handicapped by uncontrollable factors but that of P vapour allows the following scheme to be advanced: $P_4 + 2O_2 = P_4O_4$; $P_4O_4 \rightarrow 4PO$; $PO + O_2 = PO_3$; $PO_3 + O_2 = PO_2 + O_3$; $PO + PO_3 = P_2O_4$; $P_2O_4 \rightleftharpoons 2PO_2$; $PO_2 + PO_3 = P_2O_5$; $PO_2 + PO = P_2O_3$; $P_2O_3 + PO_3 = P_2O_4 + PO_2$; $P_2O_3 + O_3 = P_2O_4 + O_2$. Oxidation of P with formation of O_3 or PO_3 occurs in presence or absence of H_2O. A remainder of O_3 or PO_3 persists in the reaction product. If in presence of excess of O_2 more PO_3 than PO is present in the gas the former cannot be completely nullified by the latter, an excess of which remains capable of reacting with O_2 to O_3 and PO_2 and as PO_3 or O_3 giving the O_3 reaction in the effluent gas. The possible removal of PO_3 as P_2O_5 by PO_2 does not occur completely as long as the partial pressure of PO_2 is small; this occurs at low temp. at which P_2O_4 is present mainly as a fume. The disappearance of PO_3 or O_3 at >25° is obtained by the increase with increasing temp. of the partial pressure of PO_2, the concn. of which becomes adequate

to remove PO_3 completely as P_2O_5. The limit of the O_3 reaction with solid and gaseous P appears to lie at >24° and >26°, respectively. The PO_3 reaction disappears spontaneously with diminishing $[O_2]$ before the latter becomes so small that incomplete combustion is to be expected. When the $[O_2]$ is low PO_3 is formed less rapidly than when it is high. It is then to be expected that PO is produced in amount sufficient to transform PO_3 into P_2O_4 completely. Under these conditions PO_3 cannot be present in the effluent gas and in consequence thereof P_2O_3 results from excess of PO. Above the crit. $[O_2]$ the production of P_2O_3 is not observed since any excess of PO is converted into P_2O_4. P_2O_3, recognisable in moist air by its odour, can be produced only when the O_2 content is so small that PO_3 in the previous reactions leaves some PO. In all cases when the crit. $[O_2]$ is not reached or the crit. temp. limit is exceeded strongly reducing oxides which rapidly decolorise I–KI are present in the effluent gases in place of PO_3 or O_3. H. W.

Metaphosphoric acids. R. S. Hisar (Kimya Annali, 1938, **3**, 20—28).—The acid $(HPO_3)_6$ (I) has been obtained by the action of H_2S on its Pb salt, obtained from the known salt $Na_6(PO_3)_6,10H_2O$. This method is suggested as a general one for obtaining the unknown acids corresponding with known definite alkali metaphosphates. (I) is hexabasic, the first 4 H being strongly acidic, and differs completely in chemical and physical properties from H_3PO_4 and $H_4P_2O_7$. F. R.

Simple, polyanionic, and heteropolyanionic ammonium salts of the hydrides of phosphorus, sulphur, and germanium in liquid ammonia. P. Royen (Z. anorg. Chem., 1938, **235**, 324—336).—PH_3 dissolves in liquid NH_3 with a marked increase in conductivity. On electrolysis P is deposited on the anode. Solutions of PH_3 in NH_3 dissolve P forming a solution which is identical with that of "solid H phosphide" in liquid NH_3, and when the NH_3 is pumped off and the product acidified with HCl "solid H phosphide" results. H_2S and GeH_4 also form conducting solutions in liquid NH_3; these also dissolve P, and after removal of NH_3 and acidification orange-red sorption compounds of H_2S or GeH_4 on amorphous P remain. It is suggested that the solutions are ionised to NH_4^+ and PH_2' (or S'' or GeH_3') and that these anions form complex ions $(PH_2{\cdot}P_x)'$, $(S{\cdot}P_x)''$, or $(GeH_3{\cdot}P_x)'$. Measurement of the v.p. indicates for the polyphosphide solution a mean particle-wt. of approx. 2700. F. J. G.

Preparation and study of vanadyl bromide. F. G. Nuñez and E. Figueroa (Compt. rend., 1938, **206**, 437—439).—A 75% yield of $VOBr_3$ is obtained by passing Br vapour over a mixture of V_2O_5 and C (1 : 1·5) at a dull red heat, and cooling the mixture rapidly when reaction occurs. Br is eliminated from the product by vac. distillation over Ag. $VOBr_3$ is a mobile, dark red liquid, b.p. 75—78°, ρ^{15} 2·993± 0·002, giving dark red solutions in org. solvents. The cryoscopic mol. wt. in C_6H_6 is abnormally high (cf. A., 1912, ii, 560). A. J. E. W.

Alkali arsenites. A. Mayer (Am. Sci. Univ. Jassy, 1938, **24**, 201—210).—*$KAsO_2$* has been prepared from standardised solutions of KOH and As_2O_3; $KAsO_2$ is distinguished from $K_2As_2O_4$ by the difference in electrical conductivity in aq. solution and by the smaller adsorbability by C. The product of interaction of aq. $NaAsO_2$ and $AgNO_3$ is Ag_3AsO_3. E. S. H.

Disulphur oxide. B. S. Rao (Current Sci., 1938, **6**, 381).—S_2O exists in the yellow solution obtained by passing SO into dry CCl_4 at −12°. In this solution S_2O reacts with dil. NaOH to form equimol. proportions of Na_2S and Na_2SO_3. S_2O decomposes rapidly into S and SO_2, and, in CCl_4 solution, is more stable in presence of dry HCl. L. S. T.

Formation of free radicals by the interaction of sodium vapour and organic halides. A. O. Allen and C. E. H. Bawn (Trans. Faraday Soc., 1938, **34**, 463—467).—MeBr and Na yield Me which removes Sb and Te mirrors, the product in the latter case being Me_2Te_2. Similarly Et removes Sb whilst Ph (from PhCl) removes Te less readily, probably owing to a steric factor. The concn. of the radical diminishes as the square of the distance from the reaction zone. F. R. G.

Chromium diguanides.—See A., 1938, II, 176.

Preparation and detector action of the sulphides of tungsten, molybdenum, and rhenium. E. Tiede and H. Lemke (Ber., 1938, **71**, [*B*], 582—588).—The prep. of coarsely and finely cryst. WS_2, MoS_2, and RhS_2 is described. The last-named has no detector action. Both types of prep. of MoS_2 and WS_2 behave similarly towards high-frequency vibrations. With d.c. great differences are observed between the two sulphides; these are manifested by the different directing of the electric current within the detector. Au is not noticeably deposited from 5% $AuCl_3$ on Norwegian, Sardinian, or Japanese Mo-glance, only a slight covering being observed at isolated points. A glance of unknown origin received a considerable coat for which the ridges and cracks were favoured. Large individual leaflets of synthetic MoS_2 behave similarly to the natural material. A coarsely cryst. material compressed at 150 atm. became coated at a few spots whereas a finely cryst. synthetic product and a pseudomorph from $(NH_4)_2MoO_4$ after similar treatment rapidly acquired a complete coat. Deposition of Au is a measure of crystal formation in the sense that the well-developed surfaces do not acquire a coat. The detector effect is also caused at the well-defined crystal faces. The smooth surfaces of the natural minerals and of the synthetic products do not offer any suitable points for the deposition of Au but show exceptional detector action probably because their mirror-like surfaces have particular adsorptive forces which are certainly important for the physical action in the formation of intermediate layers. The catalytic action of MoS_2 is probably not caused by the large crystal faces responsible for the detector effect but by other active places on the surface. H. W.

Iodine. I. Masson (Proc. Roy. Inst., 1938, **30**, 99—122).—A lecture.

Preparation of metallic phosphides, in particular of manganese phosphide MnP, by high-temperature electrolysis. J. L. ANDRIEUX and M. CHÊNE (Compt. rend., 1938, **206**, 661—663; cf. A., 1914, ii, 273).—*MnP* is formed on electrolysis, at 650—850°, of mixtures of $NaPO_3$, MnO or $MnCl_2$, and NaF, NaCl, or KCl. The cooled mass is treated with dil. HCl, when MnP remains as magnetic needle crystals with a metallic lustre, ρ 5·6. MnP is attacked by hot dil. HNO_3, fused alkalis, Na_2O_2, and PbO_2, but not by HCl or H_2SO_4. A. J. E. W.

Formation of glowing iron hydroxide by precipitation at surfaces. H. W. KOHLSCHÜTTER and F. SPIESS (Z. anorg. Chem., 1938, **236**, 165—180).—The behaviour of Fe_2O_3,xH_2O on thermal dehydration has been studied by means of heating curves. The spontaneous evolution of heat is greater, and begins at a higher temp., when the hydroxide is pptd. at the surface of a cryst. Fe salt than when it is formed in solution. It is less marked, and begins at a lower temp., when the specimens have been ground or have been kept for some hr. at 310°, and it is most pronounced when the solid salt used in the prep. is anhyd. $Fe_2(SO_4)_3$. The methods used for preliminary drying of the hydroxide have little influence on the phenomenon. F. J. G.

Amorphous and crystallised oxide hydrates and oxides. XXXIX. Cold-working of ferric hydroxides and oxides. A. KRAUSE and E. TUNDAK (Z. anorg. Chem., 1938, **235**, 295—304).—When subjected to vigorous grinding α-Fe_2O_3,H_2O is completely converted into α-Fe_2O_3, becoming more readily sol. in H_2SO_4 and darker in colour. γ-FeO·OH undergoes similar changes, but a little γ-Fe_2O_3 is also formed. Under H_2O both hydroxides are stable. α-Fe_2O_3 on being ground loses its violet tint and becomes much more sol. in H_2SO_4, but without any change in the *X*-ray diagram. The changes are reversed on ignition. F. J. G.

Iron peroxide. H. WIELAND and E. STEIN (Z. anorg. Chem., 1938, **236**, 361—368; cf. A., 1909, ii, 486).—The substance obtained by the action of H_2O_2 and KOH on $FeCl_2$ in EtOH at a low temp. is Fe_2O_6 or $Fe_2O_2(OH)_2(O{\cdot}OH)_2$. It is a true peroxide of Fe^{III}. It has little oxidising action on HCO_2H and so is not the cause of the activation of H_2O_2 by $Fe^{\cdot\cdot}$. By a similar method a *Cu peroxide*, Cu_2O_5 or $Cu_2O_2(O{\cdot}OH)_2$, has been obtained. F. J. G.

Metallic carbonyls. XXVII. Heavy-metal derivatives of the metallic carbonyl hydrides. W. HIEBER and E. FACK (Z. anorg. Chem., 1938, **236**, 83—106).—By the interaction of $H_2Fe(CO)_4$ in aq. NH_3 with solutions containing the appropriate complex cation the following *compounds* have been obtained: $[HFe(CO)_4]_2[M(NH_3)_6]$ (M = Mn, Fe, Co); $[HFe(CO)_4]_2[M(ptrl)_3]$ (M = Co, Ni; ptrl = *o*-phenanthroline); $[Fe(CO)_4][Zn(NH_3)_3]$ and $[Fe(CO)_4][Cu_2(NH_3)_2]$; a *Ag–ptrl compound* of indefinite composition was also observed. A for these and some analogous compounds in org. solvents has been measured, and their constitutions are discussed. Those containing the groups $M(NH_3)_6$ or $M(ptrl)_3$ are salt-like; the others are non-electrolytes and are regarded as polynuclear mixed carbonyls. F. J. G.

Pentacyano-aquo complexes of iron. L. MICHAELIS and C. V. SMYTHE (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 347—356).—The titration curves of the reduction of $Na_2Fe(CN)_5,H_2O$ to $Na_3Fe(CN)_5,H_2O$ suggest that each compound has four times its lowest possible mol. wt., and that between the two compounds there are three intermediate forms in which part of the four Fe is in the Fe^{III} and part in the Fe^{II} states. Evidence for the quadrimol. size is strengthened by observations of colour change, rate of diffusion, and the threshold val. of coagulation of Fe_2O_3 sol. C. R. H.

Basic selenate and tellurates. G. GIRE and F. FOUASSON (Compt. rend., 1938, **206**, 351—352).—The bright green salt, $7NiO,SeO_3,nH_2O$ (I), is pptd. on reducing aq. $NiSeO_4$ with Mg at <30°; (I), which resembles de Clermont's basic sulphate (A., 1893, ii, 528), is slowly decomposed by H_2O. A basic Co salt is formed similarly. The *salt*, $2NiO,TeO_3,nH_2O$, is pptd. from $NiSO_4$ solution by Na_2TeO_4; $CoSO_4$ gives a similar compound. A. J. E. W.

Hydroxylamine compounds of palladium. I. V. I. GOREMIKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 341—343).—The following complex *compounds* have been prepared and are described. $[PdX_4](OH)_2$; $[PdX_4]C_2O_4$; *trans*-$[PdX_2Cl_2]$; $[PdX_4][PtCl_4]$; $[PdX_2(NH_3)_2][PtCl_4]$; $[PtX_4]C_2O_4$; $[PtX_4][PdCl_4]$; where $X = NH_2OH$. The Pd–X bond is weaker than the Pt–X bond in compounds of the same type. C. R. H.

(A) Galvanometric determination of hydrogen-ion concentration. (B) Galvanometric titration. A. P. SERGEEV and A. N. JAVORSKI (J. Appl. Chem. Russ., 1938, **11**, 113—116, 117—119).—(A) The test solution is connected by an agar bridge with a buffer solution, Sb electrodes connected with a galvanometer are placed in each solution, and the buffer solutions are changed until the galvanometer reading is zero, when the p_H of the two solutions is identical.

(B) The above equipment is used for electrotitration. R. T.

Potentiometric titration in non-aqueous solutions. Solvents. A. E. RUEHLE (Ind. Eng. Chem. [Anal.], 1938, **10**, 130—131).—$OH{\cdot}[CH_2]_2{\cdot}OMe$ is a suitable medium for the potentiometric determination of the acidity of materials sol. in it, using the quinhydrone electrode. Curves given for the titration of solutions of BzOH, $CCl_3{\cdot}CO_2H$, and AcOH in this solvent show sharp end-points. $COMe_2$, anisole, or dioxan can be used to enhance the solvent properties of $Bu^{\alpha}OH$ without interfering with the functioning of the quinhydrone electrode. Titration curves for asphalt, AcOH, BzOH, salicylic acid, and $CCl_3{\cdot}CO_2H$ in these mixed solvents are given. L. S. T.

Carborundum and silicon electrodes. I. Use of Si and SiC electrodes for potentiometric titration of acids and alkalis. J. A. BOLTUNOV and K. I. ISAKOVA (J. Gen. Chem. Russ., 1937, **7**, 2838—2841).—Si and SiC electrodes are applied to the electrotitration of acids and alkalis. R. T.

Use of bimetallic pairs of electrodes for titration of acids and alkalis in certain mixed solvents. J. A. BOLTUNOV and E. A. KROGIUS (J. Gen. Chem. Russ., 1937, **7**, 2842—2847).—Electrotitration of acids and alkalis in H_2O–EtOH, EtOH–$COMe_2$, or EtOH–Et_2O is possible using Pt–Ni, Pt–Sb, or Pt–Ta electrodes. R. T.

Indicator for alkalimetry and acidimetry. G. T. GALFAJAN (J. Appl. Chem. Russ., 1938, **11**, 110—112).—Solutions of the pigment of *Delphinium orientalis* are red at p_H 4, changing through violet to blue as the p_H rises from 4·2 to 6·3, and from blue to green at p_H 6·3—8·3. R. T.

Volumetric determination of the acid content of solutions containing copper and iron salts. G. ORTNER (Z. anal. Chem., 1938, **112**, 96—101).—In presence of $Cu^{..}$ the solution is decolorised with excess of $CS(NH_2)_2$ and the free acid determined by titration with 0·1N-$NaHCO_3$, using Me-orange as indicator. To prevent rapid decomp. of the complex, $(NH_4)_2SO_4$ should be added prior to titration. In presence of $Fe^{...}$ the solution is diluted, a little $CuSO_4$ (= 0·05 g. of Cu) and excess of $(NH_4)_2SO_4$ are added, and aq. $CS(NH_2)_2$ is introduced until a brownish-red ppt. forms. The mixture is shaken well and, after decolorisation has occurred, is titrated with $NaHCO_3$. J. W. S.

Acid–base titration in alcohol–water mixtures. V. Indicators in alcohol–water mixtures. H. BAGGESGAARD-RASMUSSEN and J. C. JESPERSEN (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 54—61).—The absorption coeffs. for bromothymol-blue, cresol-red, and thymol-blue in 20, 50, and 75% EtOH have been examined at various $\lambda\lambda$ and p_H vals. The transitional p_H range moves to higher vals. with increase in [EtOH]. C. R. H.

Simultaneous standardisation of volumetric solutions of acid and alkali without the use of standard titrimetric substance. D. KÖSZEGI (Z. anal. Chem., 1938, **111**, 343—348).—The acid is titrated against the alkali, using a suitable indicator. The quantities of acid and alkali used for titration end-point are then mixed without indicator and evaporated to dryness in a SiO_2 or Pt vessel. The salt formed is weighed and the normalities of acid and alkali are calc. R. S. B.

Alkalimetry for coloured solutions with methyl-red as indicator. Y. UZUMASA and Y. MIYAKE (J. Chem. Soc. Japan, 1936, **57**, 93—99).—The distribution of Me-red between H_2O and $CHCl_3$ is determined by the p_H of the H_2O. Applications of this fact in studying neutralisation processes are discussed. CH. ABS. (*e*)

Photo-electric p_H determinations in sea-water. K. BUCH (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 109—117).—Investigation of the influence of temp. and salinity shows that the method gives accurate results with sea-H_2O. C. R. H.

Quantitative analysis of mixtures of strong and weak acids, buffer and neutral salts.—See B., 1938, 416.

Solutions in liquefied gases. XIX. Acid–base indicators in liquid sulphur dioxide. XX. X* (A., I.)

Titration of solutions in liquid ammonia at room temperature. A. I. SCHATTENSTEIN (J. Phys. Chem. Russ., 1937, **10**, 766—776, 777—781).—XIX. Solutions of 29 indicators in SO_2 change their colour when alkali or acid is added. The mechanism of this effect and its importance for the theory of acids and bases are discussed.

XX. NH_4NO_3 can be titrated with KNH_2 in NH_3 in the presence of *o*-$NO_2{\cdot}C_6H_4{\cdot}NH_2$. J. J. B.

Cryohydric method for determination of moisture.—See B., 1938, 330.

Determination of chlorides in acid solution with adsorption indicator. H. D. BARNES (J. S. African Chem. Inst., 1938, **21**, 11—12).—3 drops of 1% $NHPh_2$ (in conc. H_2SO_4) are added to 10 c.c. of 5N-H_2SO_4, followed by 1 c.c. of 0·1N-$K_2Cr_2O_7$. When the mixture has become deep violet the whole is added to the acidified Cl′ solution and the $AgNO_3$ added. The AgCl ppt. is coloured blue and the solution gradually becomes grey-blue. The end-point is indicated by the return of the violet colour to the solution. Excess of indicator must be avoided. The $CHPh_3$ derivative also known as diphenylamine-blue is useless as an adsorption indicator. J. W. S.

Sulphuric acid method of accelerated analysis of barium sulphate for chlorine.—See B., 1938, 368.

***p*-Phenylendiamine hydrochloride as a reagent for oxidising agents.** E. ABRANTES, O. COSTA, and M. ROSA (Rev. Soc. Brasil. Quim., 1937, **6**, 153—159).—A 0·5% solution of *p*-$C_6H_4(NH_2,HCl)_2$ gives with dil. OCl′, Cl, Br, and I solutions a green colour passing to violet and brown, NO_2' green, changing to yellow on adding conc. H_2SO_4, MnO_4' yellow, changed by H_2SO_4 to violet, Cr_2O_7'' green similarly changed to violet, H_2O_2 yellow, changed by H_2SO_4 to red. ClO_4' and NO_3' give no colour whilst ClO_3' gives a violet colour only after addition of H_2SO_4. The mechanism of the reaction is discussed (cf. Piccard, A., 1911, i, 568). *p*-$C_6H_4(NH_2,HCl)_2$ with H_2SO_4 and subsqeuent addition of dil. OCl′ gives the violet colour and also a white ppt. which is attributed to formation of *p*-$C_6H_4(NH,HCl)_2$. F. R. G.

Volumetric determination of chlorates by the Volhard method after their preliminary reduction to chloride with zinc in acid solution. N. A. TANANAEV and M. S. VOSCHTSCHINSKAJA (J. Appl. Chem. Russ., 1938, **11**, 120—122).—H_2SO_4 and excess of Zn are added to the solution, which is filtered after reduction of ClO_3' to Cl′ is complete, and Cl′ is determined in the filtrate by Volhard's method. R. T.

Diphenylcarbazone as an indicator for mercury for the determination of bromides. J. TETÍLEK (Chem. Obzor, 1937, **12**, 184—185).—The highest acidity at which the mercurimetric determination of Br′ using diphenylcarbazone as an indicator can be carried out (even in presence of ions of heavy metals) is 0·2N-HNO_3. The best condition is neutral or very slightly acid. F. R.

Application of salts of complex cations to the microscopic detection of anions. IV. Chloro-

pentamminocobaltic chloride (purpureocobaltic chloride). L. K. YANOWSKI and W. A. HYNES (Mikrochem., 1938, **24**, 1—3; cf. A., 1937, I, 579).—Characteristic cryst. products are obtained when a saturated aq. solution (approx. 0·006M) of $[Co(NH_3)_5Cl]Cl_2$ reacts with the following anions: BrO_3', SiF_6'', C_2O_4'', xanthate, CrO_4'', $[Fe(CN)_6]'''$, and sulphosalicylate. The microscopic identification of the last three anions, and the differentiation between CrO_4'' and Cr_2O_7'' at low conens. by this method, are recommended. O. J. W.

Determination of iodine and bromine present together in air. E. S. BURKSER and V. V. BURKSER (J. Appl. Chem. Russ., 1937, **10**, 2153—2161).—200 l. of sea-air are aspirated through 75 ml. of 0·02N-KOH, 2—3 drops of N-KOH are added, the solution is evaporated to dryness, and the residue is ignited and dissolved in H_2O. Br′ and I′ in a part of the solution are oxidised to BrO_3' and IO_3' by means of NaOCl in presence of NaCl and H_3BO_3, excess of NaOCl is removed by boiling with HCO_2Na, and BrO_3' and IO_3' are determined iodometrically. In a second portion of solution I′ is oxidised to IO_3' by Cl_2, excess of which is removed as before, and the IO_3' is titrated; BrO_3' is given by the difference between the two titrations. The air of different localities on the Black Sea coast contained Br 6·7—54·0 and I 10·5—48·3 μg. per cu. m., from June to October. R. T.

Application of the ferro-dipyridyl complex in micro-analysis. N. S. POLUEKTOV and V. A. NAZARENKO (J. Appl. Chem. Russ., 1937, **10**, 2105—2108).—The complex salt $[Fe^{II}(2:2'\text{-dipyridyl})_3]SO_4$ gives characteristic microcryst. ppts. with I′ (1 μg.), CNS′ (0·2), VO_3' (0·025 V), Cr_2O_7'' or MnO_4' (0·08 Cr or Mn), ReO_4' (0·25—0·5 Re), $Fe(CN)_6''''$ (0·2), $Fe(CN)_6'''$ (0·033), $Fe(CN)_5NO''$ (0·05), $BiCl_3$ (0·1 Bi), $SnCl_2$ (0·5 Sn), $HgCl_2$ (0·02 Hg), and fluorotantalate (0·1 μg. Ta). R. T.

Colour reaction for iodate ion. A. L. GOTLIB (J. Appl. Chem. Russ., 1938, **11**, 135—139).—A drop of solution is placed on a dry filter-paper impregnated with $H_2C_2O_4$ and pyrogallol; a brown spot is obtained in presence of >0·2 μg. OI′. ClO_3', ClO_4', BrO_3', S_2O_3'', SiF_6'', MnO_4', and Br′ do not interfere, but CrO_4'', Cr_2O_7'', and I′ should be absent. The coloration developed by solutions serves for the colorimetric determination of 0·0005—0·005% KIO_3. R. T.

Mechanism of the precipitation of lead chlorofluoride. Determination of fluorine in fluorspar in absence or presence of silica. Determination of silica in presence of fluorine. P. E. WINKLER (Bull. Soc. chim. Belg., 1938, **47**, 1—46).—Pptn. of F′ from aq. NaF + $NaNO_3$ by aq. $PbClNO_3$ gives results that vary markedly according to conditions, viz., vol. of precipitant, acidity of the solution, and time of keeping after pptn. Similar variations are obtained when solutions of $Pb(NO_3)_2$ and KCl replace that of $PbClNO_3$. These difficulties are largely avoided by adding the precipitant in portions and allowing a suitable time to elapse between successive additions. The amounts to be added per portion depend to some extent on the quantity of F′ present, and the time between successive additions, generally 20 min., must be increased when substances which retard pptn. of PbClF, *e.g.*, SiO_2, are present. Factors affecting the decomp. of fluorspar by fusion with Na_2CO_3 or K_2CO_3 have been investigated and the following method is given. 0·02—0·1 g. of fluorspar is mixed with 2 g. of Na_2CO_3, and fused, finally over the blowpipe for 10 min. The fused mass is disintegrated in a Pt or Ag vessel with 100 c.c. of warm H_2O and digested for 30 min. at 100°. The F is then determined as PbClF. The view that the addition of SiO_2 is necessary for complete decomp. of fluorspar is no longer tenable. The above method can also be used for mixtures of fluorspar and quartz (>80%). After removal of Pb″ as PbS, SiO_2 can be determined in the usual way in the filtrate from the PbClF. The Ca is determined in the residue from the Na_2CO_3 fusion. L. S. T.

Determination of fluorine in fluorides.—See B., 1938, 369.

[Determination of] fluorine in food products.—See B., 1938, 445.

Determination of dissolved oxygen [in water].—See B., 1938, 328.

Reaction for free sulphur. L. VAN ITALLIE (Pharm. Weekblad, 1938, **75**, 278—280).—A trace of S in 4N-NaOH gives a blue to greenish-blue coloration when treated with C_5H_5N or $COMe_2$. The colour may be due to colloidal S. S. C.

Determination of sulphide, sulphite, thiosulphate, and carbonate present together. M. J. SCHAPIRO (Zavod. Lab., 1937, **6**, 1213—1217).—The procedures of Kurtenacker and Wollak (A., 1927, 534, 638) and of Wollak (A., 1929, 1030) give trustworthy results. Carbonates are determined in presence of large amounts of SO_3'', S_2O_3'', and S″ by a modified Fresenius–Classen procedure. R. T.

Determination of polysulphide-sulphur in alkali polysulphides. K. WINTERSBERGER (Z. anorg. Chem., 1938, **236**, 369—371).—The solution is shaken with excess of Na amalgam, whereby polysulphide is reduced to sulphide, and this is determined iodometrically. F. J. G.

Detection of sulphur in chrome leather.—See B., 1938, 417.

Determination of sulphur in solid fuels by combustion in a stream of oxygen.—See B., 1938, 337.

Determination of sulphur in coal and coke.—See B., 1938, 338.

Determination of sulphide-sulphur in technical cyanides, and potentiometric titration of solutions of cyanide melts.—See B., 1938, 367.

Analysis of mixtures of sulphuric and acetic acid and of acetates.—See B., 1938, 367.

Semi-micro-Kjeldahl method for determination of nitrogen in coal.—See B., 1938, 337.

Application of physico-chemical coefficients to the analysis of concentrated nitric acid.—See B., 1938, 367.

Use of selenium in the determination of nitrogen.—See B., 1938, 443.

Reduced-strychnine method for determining nitrates in sea-water. W. A. RIDDELL (J. Biol. Board Can., 1936, 2, 1—11).—In Harvey's method (cf. A., 1928, 389) less Zn may be used under certain conditions in reducing the strychnine. The relationship between colour developed and $[NO_3']$ is practically linear from 0·2—0·4 mg. of NO_3' per l. Precautions for obtaining consistent results are described. An accuracy of <5% of the actual NO_3' content is obtained. CH. ABS. (e)

Determination of phosphoric acid by precipitation as ammonium phosphomolybdate. W. SPENGLER (Z. anal. Chem., 1938, 111, 241—254; cf. B., 1938, 159).—Scheffer's method for determination of H_3PO_4 by titration of phosphomolybdate with NaOH gives good vals. within certain limitations. When the phosphomolybdate ppt. is washed with $COMe_2$ and dried in a vac. 57·5 mols. of NaOH (instead of 56·5 mols.) are used per mol. of P_2O_5. The same abnormal result is obtained when the ppt. is washed with EtOH or with nearly saturated aq. Na_2SO_4, but not when it is washed with 1% aq. Na_2SO_4. Possible causes of the phenomenon are discussed. The ppt. obtained in presence of $COMe_2$ probably has the composition $[(NH_4)_3PO_4,12MoO_3]_8$, $[MoO(OH)_3(ONH_4)\cdot MoO(OH)_4]_4$, $Mo(OH)_4,24H_2O,2COMe_2$. The method permits easy recovery of the expensive Mo used. J. W. S.

Determination of calcium hypophosphite with potassium permanganate. E. PRINCIVALLE (Annali Chim. Appl., 1937, 27, 538—539).—This method gives high results due to secondary decomp. of the $KMnO_4$. O. J. W.

Rapid determination of phosphorus in iron ores.—See B., 1938, 380.

Rapid determination of boric acid, zinc, and iron in zinc electrolyte.—See B., 1938, 394.

Volumetric determination of silicon in ferromanganese, cast iron, and steel.—See B., 1938, 386.

Colorimetric determination of silica and accelerated analysis of corundum.—See B., 1938, 372.

Volumetric determination of carbon in ferrochromium.—See B., 1938, 385.

Determination of carbon monoxide in products of combustion of town's gas.—See B., 1938, 340.

Determination of carbon dioxide based on the electrical conductivity of solutions of baryta. A. LASSIEUR (Compt. rend., 1938, 206, 606—608).—The CO_2 is shaken with aq. $Ba(OH)_2$ and the change in conductivity of the latter determined, using a very small current. R. S. B.

Determination of combined carbon dioxide in soaps and other detergents.—See B., 1938, 405.

Qualitative separations on a micro-scale. Analysis of the alkali group. A. A. BENEDETTI-PICHLER and J. T. BRYANT (Ind. Eng. Chem. [Anal.], 1938, 10, 107—110).—The procedure detailed for the analysis of this group from 1 mg. solid samples permits the detection and determination of 10 μg. of any alkali ion in mixtures containing >500 μg. of the others. SO_4'' is first removed as $BaSO_4$ and not $PbSO_4$, and then $K^\cdot$, $Rb^\cdot$, and $Cs^\cdot$ are separated from $Na^\cdot$ and $Li^\cdot$ by pptn. with H_2PtCl_6. The Na sub-group is analysed according to the scheme of Noyes and Bray, but in the K sub-group Cs, if present in amounts >5 μg., is first separated by pptn. with $HBiI_4$. $Rb^\cdot$ and $Cs^\cdot$ are confirmed as red crystals of $Rb_6Ag_2Au_3Cl_{17}$ and black cubes or stars of $Cs_2AgAuCl_6$, respectively. Separations are carried out in microcentrifuge cones of clear fused quartz and of Pyrex glass. L. S. T.

Enzymic histochemistry. XXII. Micro-determination of potassium. B. NORBERG (Compt. rend. Trav. Lab. Carlsberg, 1938, 21, 233—240).—Details are given of a method for the determination of $<10^{-4}$ milliequiv. of K in pure chloride solutions with an error of approx. 1 to 2×10^{-6} milliequiv. The $K^\cdot$ is pptd. as K_2PtCl_6 and converted into K_2PtI_6, which is titrated with 0·02N-$Na_2S_2O_3$. When combined with the Linderstrøm-Lang method for total $Na^\cdot + K^\cdot$ (A., 1936, 1166) as chlorides, the method can be applied to the determination of $K^\cdot$ in tissues. L. S. T.

Rapid separate determination of potassium and sodium present together. I. Determination of potassium. M. A. PORTNOV and S. K. AFANASIEV (Zavod. Lab., 1937, 6, 1442—1447).—$K^\cdot$ in 50% EtOH solution is determined by conductometric titration with 0·15N-H_2SiF_6 in 50% EtOH (this solution is stable for <3 weeks), with a mean error of 2—2·5%. Alternatively, excess of standard Mg dipicrylamine reagent (Winkel and Maas, A., 1937, I, 45) is added to an amount of salt containing 0·12—0·2 g. of KCl, the solution is shaken and filtered, and an aliquot part of the filtrate is titrated conductometrically or potentiometrically (quinhydrone electrode) with standard HCl. R. T.

Potentiometric determination of sodium oxalate by silver nitrate. J. A. ATANASIU (Z. anal. Chem., 1938, 112, 22—25).—With a Ag indicator electrode $Na_2C_2O_4$ may be determined by 0·1N-$AgNO_3$ in 50% aq. EtOH, MeOH, or $COMe_2$; an Et_2O-saturated solution is unsuitable. $K^\cdot$, $Na^\cdot$, and $NH_4^\cdot$ (1%) interfere. M. R.

Microchemical determination of small amounts of sodium in aluminium and silumin.—See B., 1938, 390.

Quantitative spectrum analysis. IX. Determination of cæsium by emission spectra. X. Determination of lithium by emission spectra. A. IWAMURA (Bull. Chem. Soc. Japan, 1938, 13, 260—265, 265—272).—IX. Solid electrodes are prepared from a solution of CsCl, "Nolit" C, and "sirupus simplex," and the [CsCl] is determined graphically from the intensity of the Cs line 4555·3 A. The sensitivity is 2×10^{-4}% of CsCl. The analysis is carried out on sample electrodes containing 0·0005—0·015% of CsCl.

X. The electrodes are prepared as in IX, and the same method is used. The sensitivity is 3×10^{-5}%

of Li with the line 6707·9 A., and 1×10^{-4}% with 6103·6 A. The range is (1 to 12) $\times 10^{-3}$% of LiCl. Samples of clay from Seto and Inuyama were found by this method to contain 3×10^{-5}% of Li.

L. S. T.

Micro-methods in qualitative analysis. J. H. REEDY (Trans. Illinois State Acad. Sci., 1935, **28**, No. 2, 131—132).—A review of technique. A test for Ag involving reduction of ammoniacal AgCl by Na_2SnO_2 is described. CH. ABS. (*e*)

Isatin-β-oxime, a new reagent for certain metals. V. HOVORKA and V. SÝKORA (Coll. Czech. Chem. Comm., 1938, **10**, 83—92).—Insol. compounds of the oxime and metal, formed on adding the former to solutions of Ag, Hg^{I}, Hg^{II}, Pb, Cu^{I}, Cu^{II}, Fe^{II}, Co, Ni, and UO_2 salts in presence of excess of NaOAc, have been examined and are described. Th salts form a sol. stable complex compound. C. R. H.

Nephelometric determination of cathodic silver in water.—See B., 1938, 463.

***o*-Tolidine as reagent for the colorimetric determination of silver [in water].**—See B., 1938, 463.

Determination of alkaline-earth metals. G. WOLF (Compt. rend., 1938, **206**, 435—437; cf. A., 1905, ii, 522).—The mixed carbonates are decomposed successively by heating in a vac., the CO_2 evolved being measured. The approx. decomp. temp. are: $CaCO_3$, 540°; $SrCO_3$, 910°; $BaCO_3$, 1050°.

A. J. E. W.

Micro-determination of calcium. G. H. ELLIS (Ind. Eng. Chem. [Anal.], 1938, **10**, 112).—A modification of Lindner and Kirk's method (A., 1937, I, 531) is described for 5 to 10 μg. of $Ca^{\cdot\cdot}$. The CaC_2O_4 is dissolved in 1 ml. of 3·5% aq. $HClO_4$ and titrated with 0·01N-$Ce(NH_4)_2(NO_3)_6$ solution which is N with respect to $HClO_4$, using *o*-phenanthroline–$Fe^{\cdot\cdot}$ or, preferably, 1% aq. setopaline C as indicator.

L. S. T.

Volumetric determination of calcium sulphate and calcium sulphide in bone black.—See B., 1938, 368.

Determination of hardness of water by direct titration [with potassium palmitate].—See B., 1938, 328.

Determination of barium and calcium. K. BARTSCH (Z. anal. Chem., 1938, **111**, 342—343).—The solution containing Ca and Ba is heated for 2—3 hr. at 100° with $(NH_4)_2SO_4 + (NH_4)_2C_2O_4 +$ AcOH. The CaC_2O_4 is dissolved from the ppt. of $CaC_2O_4 + BaSO_4$ by means of N-HCl, and the Ca determined by titration of the $H_2C_2O_4$. The $BaSO_4$ is determined by ignition. Results are accurate and independent of presence of NaCl, $MgCl_2$, and NH_4Cl.

R. S. B.

Determination of barium. H. N. TEREM (Kimya Annali, 1938, **3**, 10—19).—A volumetric method for the determination of Pb and Ba in the absence of other metals, using a solution of $(NaPO_3)_6$, is described. Direct comparison must be made with a solution of known concn. of a Pb or Ba salt, titrated under exactly the same conditions. F. R.

Rapid determination of magnesium chloride in electrolyte.—See B., 1938, 368.

Rapid determination of magnesium oxide in acid-soluble slags.—See B., 1938, 368.

Spectrum analysis of admixtures in pure aluminium and silumin.—See B., 1938, 390.

Alkalimetric determination of zinc in presence of tartrates or citrates. F. S. SCHPILEV (J. Appl. Chem. Russ., 1937, **10**, 2130—2138).—Approx. 1 mol. of H_2SO_4 is liberated per 2 mols. of $ZnSO_4$ added to excess of aq. Na K tartrate or Na_3 citrate; Zn is determined by titrating the solution with 0·1N-NaOH (phenol- or thymol-phthalein), applying an appropriate empirical factor to the calculation of the result. R. T.

Micro-separations of zinc by 8-hydroxyquinoline: zinc from calcium, strontium, barium, aluminium, chromium, and lead. C. CIMERMAN and P. WENGER (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 162—166).—Zn is quantitatively separated from $Ba^{\cdot\cdot}$, $Sr^{\cdot\cdot}$, and $Ca^{\cdot\cdot}$ by slight modifications of the volumetric method described previously (A., 1936, 1352). The method for Zn in alkaline solution (A., 1938, I, 96) furnishes a satisfactory separation from limited amounts of Al, but fails in presence of $Cr^{\cdot\cdot\cdot}$. The AcOH method (A., 1936, 1352) succeeds for limited amounts of $Cr^{\cdot\cdot\cdot}$ under the special conditions given, when no Cr–hydroxyquinoline compound is formed (cf. A., 1937, I, 377). Pb can be separated from Zn by both acid and alkaline methods, but when the ppt. is kept for 24 hr. as recommended by Stas (A., 1931, 453) high results are obtained.

L. S. T.

Polarographic studies with the dropping mercury cathode. LXXIII. Determination of zinc in presence of nickel, cobalt, cadmium, lead, copper, and bismuth. P. R. STOUT, J. LEVY, and L. C. WILLIAMS (Coll. Czech. Chem. Comm., 1938, **10**, 129—135).—To determine Zn in ashed plant materials, Zn, Ni, Co, Cd, Pb, Cu, and Bi are removed from Fe, Mn, Ca, Mg, and alkali metals as dithizone compounds sol. in $CHCl_3$. Shaking the $CHCl_3$ solution with HCl decomposes the Zn, Cd, and Pb complexes and, to a smaller extent, those of Cu, Co, and Ni. The acid layer is evaporated and the residue is dissolved in 0·1N-NH_4OAc and 0·025N-KCNS and adjusted to p_H 4·6, in which solution Zn, on electrolysis, shows a distinct polarographic wave which is not interfered with by the other metals. The waves for Ni, Co, and Cd are also distinct from each other. If the residue is dissolved in 0·5N-NH_4OAc and 0·1M-tartaric acid and adjusted to p_H 5·0, electrolysis gives well separated waves for Pb, Cu, Bi, and Cd.

C. R. H.

Polarographic studies with the dropping mercury cathode. LXXII. Simultaneous determination of nickel and zinc. P. R. STOUT and J. LEVY (Coll. Czech. Chem. Comm., 1938, **10**, 136—141).—Distinct Ni and Zn waves, showing no max., can be obtained by electrolysis in presence of 0·1N-NH_4OAc adjusted to p_H 8·5 with aq. NH_3, in which solution the deposition potentials of the two metals differ by 0·3 V. In more alkaline solutions, a max.

in the wave due to Zn occurs; this can be suppressed by addition of two drops of Me-violet (1%) to each 5 c.c. of solution. With Ni and Zn concns. of the order of 10^{-3}—10^{-4}N, determinations are possible with the usual accuracy of the polarographic method, viz., ±2%. C. R. H.

Bibliography of publications dealing with the polarographic method. J. Heyrovský and J. Klumpar (Coll. Czech. Chem. Comm., 1938, **10**, 153—173).—The 363 references cover the years 1922 to 1937. C. R. H.

Unification of results of polarographic analyses. E. S. Kronman (Zavod. Lab., 1937, **6**, 1294—1295).—The molal sensitivity of a polarographic determination of a substance is equal to the height of the wave given by a M solution of the substance, using a galvanometer placed 1 m. distant from the polarograph, and having a sensitivity of 1 amp. per mm. R. T.

Polarographic analysis.—See B., 1938, 398.

Determination of zinc in lead.—See B., 1938, 387.

Determination of zinc in maple products.—See B., 1938, 444.

Detection of cadmium by means of brucine and potassium bromide. I. M. Korenman (Zavod. Lab., 1937, **6**, 1461).—The sensitivity of the reaction is $<0{\cdot}12$ μg. Cd in absence, and 0·6—1·2 μg. Cd in presence, of the following limiting relative concns. of cations per unit concn. of Cd: Zn or Co 170, Ni or Pb 1000, Cu 550, Ag 280, Cr 120, Al 70, Fe or Ca 300, Mn 400, Bi 600, Sn 440, Sb 120, Hg 370, Mg 160, Sr 700, and Ba 430. R. T.

Determination of cadmium in zinc and zinc alloys by internal electrolysis.—See B., 1938, 387.

Determination of lead. M. V. Gaptschenko (Zavod. Lab., 1937, **6**, 1295—1296).—Polemical, in reply to Hochschtein (A., 1937, I, 476). R. T.

Determination of lead by the electrolytic deposition of lead dioxide. I. Electrolytic determination of lead. P. H. Delano and W. T. Schrenk. **II. Composition of anodic lead dioxide and its use in the determination of small amounts of lead.** T. G. Day and W. T. Schrenk (School Mines Met. Univ. Missouri Bull., 1935, Tech. Ser., **12**, No. 2, 7—29, 31—68).—I. The sample (5—150 mg. of Pb) is heated with 35 c.c. of conc. HNO_3, until no more brown fumes are evolved. 0·25 c.c. of conc. H_2SO_4 is added, and the solution is boiled for 2 min. and diluted to 140 c.c. It is electrolysed for 1·5—2 hr. at 85—95° with a sandblasted Pt anode and an initial c.d. of 5·5—7 amp. The anode deposit is assumed to be pure PbO_2.

II. The above method may be modified for determining $>0{\cdot}5$ mg. of Pb. The anodic deposit is $9PbO_2,PbO,H_2O$, *i.e.*, approx. pure PbO_2. The deposit may be dissolved in excess of standard $Fe(ClO_4)_2$, and the excess titrated, preferably potentiometrically, with $KMnO_4$. Alternatively the deposit may be treated with KI and dil. acid and the liberated I extracted with CCl_4 and determined colorimetrically. Ch. Abs. (*e*)

Determination of lead, thorium, and uranium in allanites for the purpose of geological time-measurement. E. Kroupa and F. Hecht (Z. anorg. Chem., 1938, **236**, 181—199).—Details are given of a procedure for the determination of Pb, Th, and U in allanites, using only 1 g. of material. The preliminary separations are performed by macro-methods, the final operations by micro-methods. The procedure has been tested by analyses of artificial allanites of known composition. F. J. G.

Tests for metal ions making use of organic dyes. H. J. Long and H. M. Tenney (Trans. Illinois State Acad. Sci., 1935, **28**, No. 2, 123—124).—Fluorescein gives with $Pb^{\cdot\cdot}$ in slightly alkaline solution a rose-coloured ppt. 1 part of $Pb(NO_3)_2$ in 500 pts. of H_2O may be detected. $Hg^{\cdot}$ and coloured ions interfere. Ag_2CO_3 adsorbs fluorescein forming a red ppt. (sensitivity 1 in 500; $Hg^{\cdot}$, $Hg^{\cdot\cdot}$, $Sn^{\cdot\cdot}$, $Sn^{\cdot\cdot\cdot\cdot}$, $Fe^{\cdot\cdot}$, and certain coloured ions interfere). Naphtholyellow S gives with $SnCl_2$, on addition of NaOH, an orange to pink solution (sensitivity 1 in 2000; $Bi^{\cdot\cdot\cdot}$, $Ag^{\cdot}$, and coloured cations interfere). Ch. Abs. (*e*)

Determination of lead in maple products.—See B., 1938, 444.

Spectrum analysis of lead. I. Principal binary alloys.—See B., 1938, 387.

Fractional reactions for copper. N. A. Tananaev and S. I. Palei (J. Appl. Chem. Russ., 1938, **11**, 131—134).—1 ml. of a solution in HCl of the salt, at p_H 0·5, is boiled for 5 min. with Pb foil, and the foil is washed, and heated with HNO_3. Aq. NaOAc and $K_4Fe(CN)_6$ are added to the solution, when a red ppt. forms in presence of $<0{\cdot}01$ mg. Cu. Alternatively, a solution of the material under examination is evaporated to dryness, the residue is dissolved in aq. H_2SO_4, and NH_4CNS is added, followed by NaF in amount sufficient to decolorise the solution, which is then filtered. The filtrate is made neutral, and a drop of 50% H_2SO_4 is added, followed by 1 ml. of starch solution, 0·5 ml. of 0·1N-KI, and excess of NaCl; a blue coloration is obtained in presence of $<0{\cdot}001$ mg. Cu. R. T.

Determination of copper. J. Dick (Z. anal. Chem., 1938, **111**, 260—263).—The Cu solution, diluted to 50—200 c.c., is treated in the cold with aq. NH_4OBz and $(CH_2)_6N_4$ (0·5—1 g. of each reagent in 20 c.c. of H_2O per 0·1 g. of Cu present). The ppt. is transferred to a filter, washed first with a solution containing 0·3 g. of each reagent per litre, and finally once with H_2O, dried, ignited for 10 min., and weighed as CuO. When only traces of Cu are present the ppt. can be collected on a porcelain filter, washed finally with 95% EtOH and Et_2O, dried in a vac., and weighed as $Cu_3(OBz)_6,(CH_2)_6N_4$ (cf. A., 1932, 1098). The process is applicable in presence of alkali and alkaline-earth metals, Mg, Co, Ni, Mn, Cd, Ag, and under special conditions of Pb. J. W. S.

Iodofluoride method for the determination of copper. W. R. Crowell, S. H. Silver, and A. T. Spiher (Ind. Eng. Chem. [Anal.], 1938, **10**, 80—81).—The method described previously (A., 1936, 303) has been slightly modified. Cu can then be determined

in presence of 0·3 g. of Fe, 0·2 g. of As, 0·2 g. each of As + Fe, and 0·2 g. of arsenopyrite with an error <0·1%, and in presence of 0·3 g. of As, and 0·3 g. of arsenopyrite with an error <0·2% (cf. B., 1937, 682). L. S. T.

Micro-analysis of aërosols. II. Nephelometric determination of copper by means of salicylaldoxime. D. N. FINKELSCHTEIN (J. Appl. Chem. Russ., 1937, **10**, 2123—2129).—A known vol. of air is aspirated through a 20-cm. layer of cotton wool, which is then ashed, and the residue is dissolved in 20% HCl. The filtered solution is evaporated to 3—5 ml., diluted to 30—50 ml., and excess of aq. NH_3 is added to ppt. Fe. The solution is filtered, the filtrate + washings are conc. to 10 ml., diluted to 25 ml., and an aliquot vol. is added to 3 ml. of 20% AcOH, followed by 0·5 ml. of 1% salicylaldoxime and H_2O to 15 ml. (at 25°). The turbidity developing is compared after 1·5 hr. with that given by standard Cu solutions (10—250 μg. Cu). Inorg. cations and anions do not interfere. R. T.

Conjugated precipitation of iron with copper sulphide. R. N. GOLOVATI (J. Appl. Chem. Russ., 1937, **10**, 2118—2122).—CuS pptd. by H_2S in presence of Fe salts contains 2—4 mg. Fe per g. of CuS, the amount varying with the relative concns. of Fe and Cu. The Fe content of the ppt. approaches zero in presence of 2·2N-H_2SO_4 or 2·6N-HCl, but is still considerable in 3N-HNO_3; it falls with increasing temp., or in presence of cations ($NH_4^{\cdot}$, $Ca^{\cdot\cdot}$, $Mn^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$), and rises with increasing dispersity of the CuS. R. T.

Volumetric analysis of copper. M. SUGITA and Y. YAMAMOTO (J. Soc. Chem. Ind. Japan, 1938, **41**, 34B).—Cu may be reduced to the $Cu^{\cdot}$ state by Na_2SO_3 in presence of NaCl and titrated with $KMnO_4$ previously standardised by means of pure Cu or Cu salt. K. W. P.

Determination of copper and its separation from lead. J. DICK and A. RĂDULESCU (Z. anal. Chem., 1938, **111**, 394—396).—The solution containing $Cu^{\cdot\cdot}$ is treated with a slight excess of C_5H_5N, until blue in colour, and then pptd. in the cold as $[Cu(C_5H_5N)_2][OBz]_2$ by the addition of an excess of NH_4OBz. The ppt. is ignited to CuO before weighing. NH_4 salts do not prevent quant. pptn. of the Cu, and the method can be used in presence of alkalis, alkaline earths, Mg, Mn, Co, and Ni. Separation from Pb is effected by pptn. of the Cu with C_5H_5N and NH_4OBz in presence of NH_4OAc. Pb in the filtrate can then be determined as $PbCrO_4$. L. S. T.

Micro-electrolytic determination of copper in presence of other metals by controlled potential. A. J. LINDSEY (Analyst, 1938, **63**, 159—162).—Using the apparatus described previously (A., 1936, 46), Cu in the form of $CuCl_2$ is accurately determined, NH_2OH,HCl or N_2H_4,H_2O acting as depolariser. In presence of Sb, the two metals are deposited together, redissolved in aq. HF and HNO_3, and Cu alone deposited by electrolysing in presence of CrO_4''. Sn (if as Sn^{IV}), Pb, Zn, Al, and Ni do not interfere. Using approx. 6 mg. of alloy, Cu is determined to within 0·06 mg. by this method. E. C. S.

Determination of small concentrations. XIV. Determination of copper. S. I. SINIAKOVA (J. Appl. Chem. Russ., 1937, **10**, 2109—2117).—0·5 ml. of saturated aq. NH_4Cl and 5 drops of 3% $K_4Fe(CN)_6$ are added to 10 ml. of solution, containing 0·01—0·1 mg. Cu, and >0·05 mg. Zn or 0·2 mg. Pb, followed by H_2O to 15 ml., and the coloration (stable during 30 min.) is compared with that given by standard solutions, or is determined photocolorimetrically. Tananaev and Ivanova's method (A., 1936, 695) is applicable to the approx. determination of 0·03—0·4 mg. Cu in 1 ml. of solution. Hahn and Leimbach's method (A., 1922, ii, 870) serves for the determination of <0·05 mg. Cu. R. T.

Systematic synthesis of atomic groups in analytical chemistry. II. Reactions of ethylenediguanide and of *o*-phenylenediguanide. J. V. DUBSKÝ, A. LANGER, and M. STRNAD (Coll. Czech. Chem. Comm., 1938, **10**, 103—116).—The conditions are discussed which must be satisfied by at. groups to enable them to form complexes which are of use analytically. The prep. of the Cu salt, acid sulphate, and sulphate of the Ni salt of ethylenediguanide, and of the Co^{II}, Co^{III}, Ni, Zn, and Cu^{II} salts and sulphate of the Cu^{II} salt of *o*-phenylenediguanide are described. C. R. H.

Photocolorimetric determination of copper in steels.—See B., 1938, 385.

Rapid determination of copper in mild steel.—See B., 1938, 385.

Polarographic determination of copper in steels.—See B., 1938, 385.

Electrolytic determination of copper in chromium–copper steels.—See B., 1938, 385.

Rapid determination of copper and nickel in steel.—See B., 1938, 385.

Determination of copper, antimony, magnesium, and tin in special aluminium alloys.—See B., 1938, 390.

Determination of the alloying elements in red brass and bronzes.—See B., 1938, 387.

Polarographic analysis of brass.—See B., 1938, 387.

Detection of mercury vapour. L. R. BIGGS (J. Ind. Hyg., 1938, **20**, 161—168).—Various types of apparatus are based on the blackening of paper coated with a film of Se sulphide, when exposed to air containing Hg vapour. Other types of apparatus depend on the permeability of Hg vapour to ultra-violet light. A method for cooling and filtering air which is to be sampled for Hg is described. E. M. K.

Phenylthiocarbamide as a reagent for detection of salts of mercury, copper, silver, and metals of the platinum group. M. J. SCHAPIRO and M. I. RUD (J. Appl. Chem. Russ., 1938, **11**, 140—141).—5 drops of 2% NH_2·CS·NHPh in EtOH are added to 1 ml. of solution, when gray-black, yellow-brown, white, or yellow ppts. or turbidities are obtained with Hg^I 20, Ag 10, Cu^{II} 10, or Au^{III} 10, Pt^{IV} 50, or Pd^{II} 20 μg., respectively. Fe, Al, Bi, Mn^{II}, Zn, Cd, Ni, Co, Sb, As^V, Sn^{II}, Tl^{III}, Ce^{IV}, W, Mo, V^V,

Te^{IV}, La^{III}, Ta^{V}, Nb^{V}, Er^{III}, Y^{III}, Ba, Ca, Sr, Be, K, Na, Li, or Cs do not interfere. R. T.

X-Ray spectroscopic determination of lanthanum, neodymium, and gadolinium in the presence of other rare-earth elements. K. KIMURA (Bull. Chem. Soc. Japan, 1938, **13**, 10—27).—La can be determined by comparing the intensity of its $L\beta_2$ line with that of the Ce $L\beta_3$ line, whilst Nd and Gd can be determined by comparing the intensities of the $L\alpha_1$ lines with those of the Ce $L\beta_1$ and Nd $L\beta_2$ lines, respectively. J. W. S.

Potentiometric determination of lanthanum and thorium as oxalate. J. A. ATANASIU (Z. anal. Chem., 1938, **112**, 19—22; cf. following abstract).—La is titrated in 50% EtOH at 60°. Small amounts of $K^{\cdot}$ have no appreciable effect, but $Na^{\cdot}$ and $NH_4^{\cdot}$ interfere if present in amounts >1 and 3%, respectively. Under the conditions Th titrations were unsatisfactory. M. R.

Potentiometric determination of cerium as oxalate. J. A. ATANASIU (Z. anal. Chem., 1938, **112**, 15—19).—With a Pt indicator electrode, neutral $CeCl_3$ and $Ce(NO_3)_3$ solutions can be titrated with 0·1M-$Na_2C_2O_4$ more satisfactorily in 50% EtOH or $COMe_2$ than in H_2O. $Na^{\cdot}$ and $NH_4^{\cdot}$ (1%), in contrast to $K^{\cdot}$, accentuate the change at the equivalence point. M. R.

Determination of aluminium and aluminium oxide in steels.—See B., 1938, 386.

Quantitative spectrographic analysis of aluminium and its alloys.—See B., 1938, 390.

Analysis of aluminium–lithium alloys.—See B., 1938, 390.

Visual spectral-analytical method for rapid identification of aluminium and magnesium alloys.—See B., 1938, 390.

Methods of analysis for determining alloy constituents in aluminium.—See B., 1938, 390.

Determination of aluminium oxide in aluminium bronze.—See B., 1938, 390.

Methods of determination for micro-samples; applications to metallurgical studies. A. PORTEVIN and A. LEROY (Compt. rend., 1938, **206**, 518—520).—Methods of analysis suitable for 1-mg. samples are discussed. Mn is determined volumetrically as $HMnO_4$; P and Cr are determined colorimetrically with a photo-electric colorimeter, P as a blue phosphomolybdic complex, and Cr as the diphenylcarbazide complex. These methods are suitable for the study of the heterogeneity of alloys, metallic diffusion, and the composition of surface layers. A. J. E. W.

Spectrophotometric determination of manganese, nickel, and phosphorus in iron and steel.—See B., 1938, 386.

Zinc oxide separation as applied to the determination of manganese in special cast irons.—See B., 1938, 382.

Colorimetric determination of iron with salicylic acid. Spectrophotometric study. J. P. MEHLIG (Ind. Eng. Chem. [Anal.], 1938, **10**, 136—139).—The method is satisfactory provided that experimental conditions are rigidly controlled. The optimum p_H val. is 2·6—2·8, and $\geq$1 ml. of the reagent (10% aq. solution of the Na salt) and 12 ml. of 1 : 1 AcOH should be used per 100 ml. of the final solution containing 0·5 mg. of Fe. The colour system conforms to Beer's law, and the colour is stable in diffuse light for 66 hr. Solutions must be protected, however, from direct sunlight. The effect of common anions and cations with limiting concns. are tabulated. Many of these, *e.g.*, tartrate, oxalate, citrate, PO_4''', P_2O_7'''', AsO_4''', CN', WO_4'', F', SO_3'', S_2O_3'', I', CNS', NO_2', coloured cations, and cations giving ppts. with the reagent, must be removed. L. S. T.

Determination of iron with *o*-phenanthroline. W. B. FORTUNE with M. G. MELLON (Ind. Eng. Chem. [Anal.], 1938, **10**, 60—64).—A crit. spectrophotometric study of various factors, including the effects of 55 ions, which may affect the formation of the coloured complex. Saywell and Cunningham's method (A., 1937, I, 199) is satisfactory for small amounts of Fe. It is more sensitive than many other methods, and in a 1-cm. comparison cell the range is 0·10 to 6·00 p.p.m. NH_2OH is the best reducing agent; 0·1 ml. of an aq. 10% solution is required for each p.p.m. of $Fe^{'''}$. Na_2SO_3, HCO_2Na, and CH_2O are unsatisfactory owing to the formation of complexes with $Fe^{'''}$. 6 ml. of aq. 0·10% *o*-phenanthroline are required to produce the max. colour with 5·0 p.p.m. of Fe. Beer's law is obeyed. Intensity of colour is independent of p_H over the range 2·0 to 9·0. The colour is stable for $\leq$6 months, including 100 hr. under ultra-violet light during an accelerated fading test. Serious interference by other ions is not marked, but Bi''' and $Ag^{\cdot}$ must be absent, and only 1 p.p.m. of Hg'' and 2 of Ni'' can be present. p_H is an important factor in the interferences produced by ions, especially anions. L. S. T.

Use of quinoline for microchemical detection of certain metals. M. V. GAPTSCHENKO and O. G. SCHEINTZIS (Zavod. Lab., 1937, 6, 1220—1223).—The characteristic crystals formed with quinoline in presence of NH_4CNS or KI by certain cations serve for detection of $\leq$ Fe 0·2—0·3, Ag 0·1, Zn 2·5, Cd 0·15, and Sn 1·5 μg. R. T.

Ferromagnetic impurities. F. W. CONSTANT and J. M. FORMWALT (Physical Rev., 1938, [ii], **53**, 432).—A method is described whereby very minute ferromagnetic impurities in various materials may be detected by placing the specimen in a strong magnetic field and subsequently measuring the magnetic moment due to remanant magnetisation. A magnetic moment of 2×10^{-7} per c.c. could be detected, and results for various materials are tabulated. A sensitive method of detecting magnetic anisotropy is indicated. N. M. B.

Quantitative spectral analysis of highly-alloyed iron.—See B., 1938, 385.

Rapid determination of iron in pharmaceuticals.—See B., 1938, 453.

Photometric determination of cobalt. H. T. MACPHERSON and J. STEWART (Biochem. J., 1938, **32**, 763—767).—Co is determined as a complex with

nitroso-*R*-salt by means of the Pulfrich photometer with an accuracy of 0·1 p.p.m. A green filter makes the removal of Fe unnecessary but for ease of working large quantities can be removed with ZnO. Cu must be removed by displacement with Al but Mn does not interfere even in large quantities. The quantity of Co present in grass is < in the parent soil; Co was not found in blood. E. M. W.

Micro-determination of cobalt by means of anthranilic acid. II. Pregl and Emich techniques. III. Effect of salts. P. WENGER, C. CIMERMAN, and A. CORBAZ (Arch. Sci. phys. nat., 1937, [v], **19**, Suppl., 156—159, 160—162).—II. Details involving the use of the Pregl filter-tube and the Emich filter-stick are given. The max. relative error is ±0·33%. The technique (A., 1938, I, 98) using the Schwarz–Bergkamf beaker is the easiest and that using the Pregl tube the most difficult. The former is recommended for amounts of $Co^{"}$ between 0·1 and 4 mg., that of Emich for 1 to 4 mg., and that of Pregl for >4 mg. since it permits the use of larger vols. of solution.

III. Relatively large amounts of NaCl, and moderate amounts of NH_4Cl, do not affect the results, but NaOAc must be absent. Acid Co solutions should be neutralised with Na_2CO_3 (turbidity) and cleared with 1 to 3 drops of dil. (1 : 200) HCl. Excessive amounts of acid should first be removed by evaporation. L. S. T.

Electrolytic determination of nickel in steel.—See B., 1938, 385.

Potentiometric titration of nickel [in steel] without compensation.—See B., 1938, 385.

Use of tin amalgams in chemical analysis. I. V. TANANAEV and E. G. DAVITASCHVILI (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 1397—1405).—Reduction of Mo^{IV}, V^{V}, Ti^{IV}, W^{VI}, Au^{III}, and Pt^{IV} by Sn amalgam occurs in various ways according to the difference between the oxidation-reduction potential of the ions and Sn amalgam. If the difference is small (Mo, Ti, Fe), Sn^{II} is formed, but if the difference is considerable, Sn^{IV} is produced intermediately. In the former case, reduction may be carried out in H_2SO_4, but in the latter only in HCl. The reactions serve for determination of the above ions. E. S. H.

Determination of molybdenum [in steel].—See B., 1938, 386.

Analytical chemistry of tungsten and molybdenum. II. H. YAGODA and H. A. FALES (J. Amer. Chem. Soc., 1938, **60**, 640—643; cf. A., 1936, 1222).—Procedure for determining W and Mo in alloy steels involves separation of W and Mo from other metals by pptn. with α-benzoinoxime, ignition to the mixed oxides, dissolution of oxides and pptn. of MoS_3 in buffered aq. HCO_2H, ignition and weighing of MoO_3, treatment of the sulphide filtrate and pptn. of W by cinchonine, and ignition and weighing of WO_3. Small amounts of MoO_3 or WO_3 are advantageously determined by pptn. and weighing as Tl_2MoO_4 and Tl_2WO_4, respectively. A modified Gooch filter and desiccator are described. E. S. H.

Detection of titanium ion. O. K. DOBROLIUBSKI (J. Appl. Chem. Russ., 1938, **11**, 123—125).—Ti^{IV} catalyses the reduction of methylene-blue by Zn in 6N-HCl; the reaction serves for detection of Ti^{IV} in presence of Fe, U^{IV}, Cr, or Mn. R. T.

Determination of antimony. J. PENS (Bull. Soc. chim. Belg., 1938, **47**, 129—134).—Sb is separated from other metals by the usual methods, obtained in solution as $KSbO_3$, and determined volumetrically by treating with KI in presence of HCl and titrating the liberated I with $Na_2S_2O_3$. E. S. H.

Semi-micro gravimetric determination of antimony. G. SPACU and A. POP (Z. anal. Chem., 1938, **111**, 254—260).—The neutral or slightly acid solution containing ≯0·05 g. of Sb and ≯1 g. of alkali-metal salt is treated with slight excess of dil. aq. NH_3. The solution is heated almost to the b.p. and 0·5—1 g. of pure Na_2S is added. The Sb_2S_3 pptd. initially should redissolve and a clear solution result. 5—6 drops of conc. aq. Na polysulphide are added and the solution is again heated. After dilution, excess of cold aq. $[Cr\ en_3]Cl_3,3{\cdot}5H_2O$ [en = $(CH_2{\cdot}NH_2)_2$] is added and the mixture allowed to cool. After 2 min. golden crystals or plates begin to separate, and after 5 min. the vessel is cooled in cold H_2O. After 2 hr. the solution is filtered through a porcelain filter, and the ppt. washed with dil. aq. NH_3 and then 5—6 times each with EtOH and Et_2O, and dried for 15—20 min. in a vac. desiccator. It has the composition $[SbS_4][Cr\ en_3],2H_2O$. In presence of >1 g. of alkali salt the solution is almost neutralised to phenolphthalein and then neutralisation completed with NH_3. After addition of the reagent and cooling 15—20 c.c. of EtOH are added per 100 c.c. of solution. J. W. S.

Analysis of alloys by Glazunov's electrographic method.—See B., 1938, 393.

Development of electro-drop analysis. IV. H. FRITZ (Mikrochem., 1938, **24**, 22—28; cf. A., 1937, I, 579).—The electro-drop detection of Bi and Sb by means of the $CS(NH_2)_2$ reaction is described. O. J. W.

Colorimetric and spectrophotometric analysis of bismuth alloys.—See B., 1938, 388.

Rapid determination of bismuth in copper, brasses, bronzes, etc.—See B., 1938, 387.

Extraction of niobium and tantalum oxides from loparite, in chemical analysis. N. V. ALEXEEVSKAJA and M. S. PLATONOV (J. Appl. Chem. Russ., 1937, **10**, 2139—2143).—The entire Nb and Ta content of loparite is extracted by H_2O from its melt with KOH, ≯ traces of Ti passing into the extract. With K_2CO_3 the entire Ta content, but only part of the Nb, is present in the extract; Ti and Fe are absent. R. T.

Application of active amalgamation to analysis of gold–platinum slimes.—See B., 1938, 389.

Micro-titration of platinum in cupellation beads.—See B., 1938, 389.

Specific micro-reaction for palladium. R. SCHOENTAL (Mikrochem., 1938, **24**, 20—21).—A sp. reagent for Pd is obtained by warming 1 g. of

p-$NH_2 \cdot C_6H_4 \cdot COMe$ with 40 c.c. of H_2O containing 2 c.c. of conc. HCl and, after cooling, diluting to 100 c.c. The reagent is added to an equal vol. of the test solution, and the mixture shaken for a few min. A yellow cloudiness or ppt., due to a complex salt, indicates Pd in presence of Pt, Ir, Os, Ru, Rh, Au, and Fe. Ce salts interfere and must be removed. The sensitivity of the reaction is 1 in 2×10^5. O. J. W.

Qualitative separations on a micro-scale. V. Separation and detection of osmium and ruthenium. A. A. Benedetti-Pichler and J. R. Rachele (Mikrochem., 1938, **24**, 16—20; cf. A., 1938, I, 95).—The separation method of Noyes and Bray, based on the volatility of OsO_4 and RuO_4, has been adapted to the microchemical scale. The residue obtained after removal of Se, As, and Ge as volatile bromides is treated with HNO_3 and distilled at 110—115°. The distillate of OsO_4 is absorbed in 50% KOH. The residue is treated with 72% $HClO_4$ and further distilled at 160° and the distillate of RuO_4 absorbed in 50% KOH. Confirmatory tests for Os and Ru are given. The scheme outlined gave satisfactory results with mixtures having ratios of Os : Ru varying from 1 : 100 to 100 : 1. O. J. W.

Wetting measurements [for minerals] as a physico-chemical method of analysis and for characterising materials and processes.—See B., 1938, 390.

M.p. determination under mercury. M. A. Coler (Ind. Eng. Chem. [Anal.], 1938, **10**, 164—165).—0·1 c.c. of the solid, fixed to the bulb of a thermometer by means of wire, is heated in a beaker of Hg. Satisfactory results have been obtained with carnauba wax, candelilla wax, Glyco Wax A, and BzOH. The method avoids any change that may result from pre-melting, especially in resins. L. S. T.

Mixed m.p. determination in the Fuchs micro-apparatus. E. Suomalainen (Suomen Kem., 1938, **11**, B, 8).—The two substances are dissolved and the m.p. is taken on the residue after evaporation of the solvent, in order to ensure intimate mixing. M. H. M. A.

Effects of gas velocity, diffusion, and heat transfer on the efficiency of reaction furnaces. V. Temperature distribution in a reaction tube during decomposition of nitrous oxide on cupric oxide at a steady rate. G. Damköhler and G. Delcker (Z. Elektrochem., 1938, **44**, 228—239).—The elevation of temp. due to evolution of heat in an exothermic reaction is a function of many parameters. Keeping most of these const. it is first assumed that the distance of the temp. max. along the tube $\propto$ velocity of the gas but that its val. is independent of this. Experimental and theoretical results are then compared and deviations discussed. T. H. G.

Axial distribution of temperature in a tubular contact furnace for an exothermic constant-volume reaction of the first order proceeding at a steady rate. G. Damköhler (Z. Elektrochem., 1938, **44**, 240—243; cf. preceding abstract).—Mainly mathematical. Consideration of the heat conductivity along the furnace improves the agreement between theoretical and experimental results. T. H. G.

General physico-chemical foundations of thermal separation processes. A. Eucken (Österr. Chem.-Ztg., 1938, **41**, 137—144).—A lecture. Methods which make use of the different thermal velocities of mols., and those which depend on the attainment of an equilibrium, are discussed and illustrated. C. R. H.

Manipulation of the Farkas microthermal conductivity analysis apparatus. H. F. Walton (Trans. Faraday Soc., 1938, **34**, 450—451).—Improvements in technique are described. F. R. G.

Polarimetric determination of optical properties. R. M. Emberson (Physical Rev., 1936, [ii], **50**, 396).—The polarimetric method of determining the optical properties of a surface has been critically investigated. For thin metallic films on glass the computed thicknesses were of the correct order of magnitude, but were not independent of the angle of incidence of observation. L. S. T.

Interference spectrographs for the study of fine structures in molecular spectra. S. Imanishi (Bull. Chem. Soc. Japan, 1938, **13**, 77—84).—The electronic fine structures in He bands and the isotopic fine structure of AuH bands have been investigated with double dispersion systems, arranged at right angles to one another. J. W. S.

Zero position of a polarising Nicol. J. R. Collins (Rev. Sci. Instr., 1938, **9**, 81—82).—A method of determining the zero position is based on the reversal of phase of the light vibrating in the plane of incidence at the polarising angle, but carried out at angles of incidence far enough from the polarising angle to allow sufficient light for easy measurements. N. M. B.

Monochromators for purposes of irradiation. J. W. Perry (Proc. Physical Soc., 1938, **50**, 265—274).—The conditions for a large energy output are analysed and expressed in a convenient form. A new type of monochromator for large output is described. An instrument const. is proposed as a measure of the output-capacity. N. M. B.

Photo-electric spectral photometer for measurements in the far ultra-violet. W. Deck (Helv. Phys. Acta, 1938, **11**, 3—58).—Apparatus affording an accuracy of 0·1% down to 2000 A. is described. O. D. S.

Technical development of a light source with constant energy throughout the visible region. M. von Ardenne (Z. tech. Physik, 1938, **19**, 41—43; cf. A., 1937, I, 595).—By the use of a seven-component fluorescing plate a mains-operated light source with intensity const. to 12% from 4600 to 6600 A. has been obtained. The total intensity can be regulated automatically. O. D. S.

Elimination of the human element from colorimetric analysis. J. S. Brown (Canad. Chem., 1938, **22**, 108).—The use of the electrophotometer to give increased precision over visual methods of comparison is described. L. S. T.

Integrated intensity from *X*-ray powder photographs. E. O. WOLLAN (Rev. Sci. Instr., 1938, **9**, 79—81).—A simplified method of analysing microphotometer traces is described. N. M. B.

Precision powder camera for photographs at high temperatures, and apparatus for measuring *X*-radiograms. F. SCHOSSBERGER (Z. Krist., 1937, **98**, 259—265; cf. A., 1936, 1481).—A cylindrical vac. camera is described for series of equatorial Debye–Scherrer photographs at temp. 0—1400° (thermocouple), and adaptable at room temp. to the single-crystal rotation method. Films are measured to 10 μ. by a modification of Sauter's comparator (A., 1937, I, 226). I. McA.

***X*-Ray micro-analyser.** L. VON HÁMOS (J. Sci. Instr., 1938, **15**, 87—94).—A detailed account of an instrument previously described (cf. A., 1937, I, 479). N. M. B.

Vacuum *X*-ray spectrograph and registering microphotometer. A. D. EVSEEV (Zavod. Lab., 1937, **6**, 1284—1287).—Apparatus is described. R. T.

Theoretical resolving power of the electron microscope. R. REBSCH (Ann. Physik, 1938, [v], **31**, 551—560).—The resolving power of the electron microscope is limited by the spherical aberration error (cf. Glaser, A., 1936, 46) and therefore depends on the focal length of the objective lens which has a lower limit determined by constructional difficulties. For the space-charge- and grid-free lens the practical limit of resolving power is calc. to be from 10 to 100 λλ. O. D. S.

Micro-portable quinhydrone electrode. A. ITANO (Compt. rend. Trav. Lab. Carlsberg, 1938, **22**, 235—238).—An electrode which can be used with 0·05 c.c. of solution is described. C. R. H.

Calomel half-element. P. A. KRJUDOV (Zavod. Lab., 1937, **6**, 1495).—A portable HgCl cell of simple construction is described. R. T.

Electrometric p_H apparatus. G. LAZAR and A. H. MEYLING (J. S. African Chem. Inst., 1938, **21**, 3—7).—The solution under test and a standard buffer solution of known titration curve, each with quinhydrone added, are connected through a KCl bridge, and the existence of a p.d. between Pt electrodes in the solutions is detected by a capillary electrometer. Standard acid or alkali is added until no deflexion is observed. The p_H val. of the buffer solution at this point is deduced from tables. The same technique can be applied to the adjustment of a liquid to a definite p_H or to electrometric titration. J. W. S.

Glass electrode for p_H measurements on small quantities of solutions. Y. KAUKO and L. KNAPPSBERG (Z. Elektrochem., 1938, **44**, 261—263).—The glass electrode can be used to determine the compositions of HCO_3'–Cl′ solutions and the CO_2 content of gas mixtures under certain conditions. T. H. G.

Determination of specific conductivity of river water, from the internal resistance of a galvanic element. G. M. VAINSCHTEIN (Zavod. Lab., 1937, **6**, 1471—1474).—The elements $Zn|ZnSO_4$ and $Cu|CuSO_4$ are connected to a galvanometer, and with each other by a bridge, consisting of two side-tubes filled with KCl in agar, in contact with river-H_2O flowing through a U-tube; the deflexion of the galvanometer reading from the position for pure H_2O ∝ the sp. conductivity of the H_2O. R. T.

Use of new capillaries in [electrical] polarography. H. SIEBERT and T. LANGER (Chem. Fabr., 1938, **11**, 141—142).—The use of thermometer capillaries 50 μ. in diameter and of 2 mm. wall thickness for polarography is described. The p.d.–current curve for 0·001M-$CdCl_2$ in presence of 0·1N-KCl and 0·2% of gelatin is used as an example. R. S. B.

Photo-electric relay unit. G. W. JOSTEN (Ind. Eng. Chem. [Anal.], 1938, **10**, 165). L. S. T.

Wilson cloud chamber for the study of showers. R. B. BRODE, H. G. MACPHERSON, and M. A. STARR (Physical Rev., 1936, [ii], **50**, 389).—An automatic cloud chamber 30 cm. in diameter and 10 cm. deep has been constructed for the study of cosmic-ray showers. L. S. T.

New methods in mass spectroscopy. A. J. DEMPSTER (Proc. Amer. Phil. Soc., 1935, **75**, 755—767).—An instrument in which the ion source is a high-frequency spark from a Tesla circuit is described. Au shows only the 197 isotope. ^{199}Au, if present, is <0·1%. The at. wt. of Au (197·2) is too high. There are 8 isotopes of Cd: 106, 108, 110, 111, 112, 113, 114, and 116. Some of the 12 lines found for Ce are due to La, Pr, and Nd. Pt has 5 isotopes, Pd six, and U two. ^{235}U is the parent of the Ac radioactive series. CH. ABS. (*e*)

Pulse amplifier. R. B. ROBERTS (Rev. Sci. Instr., 1938, **9**, 98).—A simplified inexpensive design is described. Satisfactory results in counting α-particles and slow neutrons were obtained. N. M. B.

Triode vacuum tube scale-of-two circuit. H. LIFSCHUTZ and J. L. LAWSON (Rev. Sci. Instr., 1938, **9**, 83—89).—Disadvantages enumerated for the thyratron type scale-of-two circuit are overcome by the circuit described. Accurate high-speed tests show the resolution time to be $6·5 \times 10^{-6}$ sec. New methods of interpolation are presented. N. M. B.

Electron-multiplier for measuring ionisation currents. W. H. RANN (Nature, 1938, **141**, 410—411).—An arrangement similar to that described by Bay (A., 1938, I, 216) detects currents ~10^{-14} amp. and amplifies currents of 10^{-12} amp. to 10^{-6} or 10^{-5} amp., so that they can be measured on a micro-ammeter or milliammeter. L. S. T.

Geiger-Müller counters for special purposes. G. L. LOCHER (Physical Rev., 1936, [ii], **50**, 1099).—The design, construction, and characteristics of new forms, including γ-ray, particle, neutron, and photo-electric counters, and counters filled with Br, I, $NPhMc_2$, and anisole vapours, are described. L. S. T.

Temperature dependence of Geiger-Müller counter characteristics. D. B. COWIE (Physical Rev., 1936, [ii], **50**, 385).—The increase in the no. of discharges resulting from a rise in temp. is attributed to thermionic emission from the walls of the counter.

With Ni oxide and Cu oxide counters the order of magnitude of the rates is inversely ∝ the work functions of the metals. No change in rate occurs when the temp. is decreased from room temp. to <0°. Starting potentials are also lowered by a rise in temp. L. S. T.

Proportional counter for studying neutron intensities and neutron-stimulated nuclear disintegrations. R. D. EVANS and M. H. KANNER (Physical Rev., 1936, [ii], **50**, 394).—A simple counter for neutrons has been developed by equipping a cylindrical Li-cathode tube counter with a wire anode of large diameter. The negligible sensitivity of the counter to β-rays and intense γ-radiation suggests its use with electrode materials of C, Mg, Al, P, S, Cr, and Zn for direct observation of α-rays or protons produced in nuclear disintegrations by neutrons. L. S. T.

Statistical analysis of the counting rate meter. L. I. SCHIFF and R. D. EVANS (Physical Rev., 1936, [ii], **50**, 873). L. S. T.

Modified high-speed Geiger counter circuit. H. V. NEHER and W. H. PICKERING (Physical Rev., 1938, [ii], **53**, 316).—Improvements on a circuit previously reported (cf. A., 1936, 1084) are described. N. M. B.

Multivibrator Geiger counter circuit. A. RUARK (Physical Rev., 1938, [ii], **53**, 316—317).—A discussion of the circuit described by Getting (cf. A., 1938, I, 160). N. M. B.

Non-ohmic resistance for use with Geiger–Müller counters. G. P. S. OCCHIALINI (J. Sci. Instr., 1938, **15**, 97—99; cf. Neher, A., 1936, 1084).—The normal type of photocell is replaced by a thermionic valve, used with its filament cold but illuminated from outside so as to act as a photocell. N. M. B.

Determination of mol. wts. of vapours near the b.p. J. D. INGLE and H. P. CADY (J. Physical Chem., 1938, **42**, 397—407).—Apparatus for measuring the v.d. of substances near their b.p. is described. The mol. wts. of H_2O, D_2O, and lower aliphatic alcohols determined by this method are in all cases > the corresponding formula wts., and decrease linearly with rise of temp. over a range of 20°. Causes of the deviations are discussed, and heats of vaporisation are calc. F. L. U.

Determination of at. wts. by means of the mass-spectrograph. J. MATTAUCH (Z. anorg. Chem., 1938, **236**, 209—220).—A review. F. J. G.

Apparatus for the determination of carbon dioxide in carbonates and mineral waters. R. FRESENIUS and F. NEUMÜLLER (Z. anal. Chem., 1938, **111**, 265—267).—A compact apparatus described comprises a 250-c.c. flask connected to a spiral condenser, fitted with a H_2SO_4 washing vessel and drying column, and leading to an absorption vessel containing aq. KOH. Addition of HCl is effected through a small separating funnel, so fitted that CO_2-free air can be passed through it and thence through the remainder of the apparatus. All connexions are made through standard ground joints. J. W. S.

Automatic null-point device for titration. I. F. LIUBIMOV (Zavod. Lab., 1937, **6**, 1496). R. T.

Apparatus for volumetric determination of carbon in steels and ferro-alloys by Eder's method.—See B., 1938, 385.

Generation of hydrogen sulphide for analysis. L. PALASCIANO (Z. anal. Chem., 1938, **111**, 263—264).—A 200-c.c. round flask of high m.p. glass is fitted with a Kjeldahl trap and delivery tube bent twice at right angles. The end of the latter is passed through a stopper into a test-tube fitted with a side tube. A mixture of paraffin wax (25%), kieselguhr (25%), and S (50%) is introduced into the flask. When heated this evolves H_2S at a readily controllable rate, the gas being washed through the test-tube, which also serves to prevent the metal salt solution from being drawn back into the flask. J. W. S.

Sampler for flowing gas. S. TSUNEOKA (J. Soc. Chem. Ind. Japan, 1938, **41**, 60B).—A glass pipette has a three-way tap at top and bottom so that it can be swept through by the gas, and then put in communication with a reservoir of confining liquid while the sample is withdrawn through the top side-tube. A. R. PE.

Apparatus for sucking fluid from a circulating system into containers. K. HERZOG (Z. ges. exp. Med., 1938, **102**, 292—300).—A detailed description is given of two devices which allow fluids to be sucked from a circulating system into containers at exactly controlled intervals and speed. A. S.

Method of limiting densities and its present precision. E. MOLES (Arch. Sci. phys. nat., 1938, [v], **20**, 59—65; cf. A., 1937, I, 379; 1938, I, 135).—A general discussion of the method and corrections, and the accuracy of available contemporary data illustrated for numerous substances. N. M. B.

Use of platinum crucibles in a reducing atmosphere. K. W. FRÖHLICH (Glastech. Ber., 1938, **16**, 60—61).—Pt crucibles are unchanged when heated at 1250° with a charcoal packing. Recrystallisation of the Pt occurs when a glass melt is kept at 1250° in a Pt crucible for 8 hr. but the crucible is not thereby adversely affected. The presence of Zn, As, or P or of free silicic acid in a glass melt may cause damage to a Pt container. O. D. S.

Fused magnesia crucibles. E. P. BARRETT and W. F. HOLBROOK (Ind. Eng. Chem. [Anal.], 1938, **10**, 91—93).—The reactions of fused MgO with C, methods of making small crucibles, and resistance to high temp. and chemical reactions are discussed. An improved method of making, in which dry MgO of mixed size is packed into specially-designed moulds of Acheson graphite by means of an electric vibrator, and then fired at 1650—1700°, is described. Advantages of the method are pointed out. L. S. T.

Fume tube for micro-Kjeldahl digestions. J. S. BLAIR (Ind. Eng. Chem. [Anal.], 1938, **10**, 112).—Fumes are removed by blowing compressed air over the open end of the tube towards the exit. L. S. T.

Micro-pyknometric method for [determining] the specific gravity of heavy solids. F. A. BANNISTER and M. H. HEY (Min. Mag., 1938, **25**, 30—34).—Fragments of the solid are introduced with $CHBr_3$ into a SiO_2 tube of 0·5 mm. bore closed at one end. From the length of the $CHBr_3$ column and the wt., ρ can be deduced. The accuracy of ρ determinations by various methods is discussed. L. J. S.

Precision densitometer. M. CRESPÍ (Anal. Fís. Quím., 1937, **35**, 123—133).—An apparatus for determination of d of $<0·5$ c.c., especially of absorbent materials and powders, with an error $\pm 0·05\%$ is described. The substance is placed in a gaseous medium and the variation of vols. measured at const. pressure. Calibration is effected by a liquid of known d. F. R. G.

Measurement of the adiabatic compressibility of liquids. J. VILLEY (Compt. rend., 1938, **206**, 655—658).—The adiabatic compressibility can be determined by observing the displacement of a piston in a perforated cylinder of the liquid, under the action of an impulsive force. The theory of the method is developed. A. J. E. W.

Accurate hydrogenation apparatus. H. JACKSON (J.S.C.I., 1938, **57**, 96—98).—Details are given for the construction and working of an accurate hydrogenation apparatus for ordinary laboratory use. The all-glass apparatus functions at atm. pressure and can be used for hydrogenating 0·05—2·0 g. of substance. An electrical heating attachment enables the reaction to be carried out at elevated temp.

Modification of Hickman's distillation pump. L. MALTER and N. MARCUVITZ (Rev. Sci. Instr., 1938, **9**, 92—95; cf. Hickman, B., 1936, 575).—The modified pump described yields very low ultimate vac., operates against moderately high backing pressures, and is made entirely of metal. Tests of the durability of Octoil as a pumping medium are reported. N. M. B.

Two-stage oil diffusion pump of metal for use on large volumes. J. E. HENDERSON (Physical Rev., 1936, [ii], **50**, 388).—The pump described eliminates, to a large extent, the difficulties encountered in the initial evacuation of large vols. L. S. T.

Safety valve for water pump. A. FOURNIER (Bull. Soc. Chim. biol., 1938, **20**, 252).—The apparatus prevents the back flow of the H_2O. A. L.

Metallography: a new technique. B. CHALMERS and W. E. HOARE (Nature, 1938, **141**, 475).—The technique consists in observing or photographing the interference fringes that form between a partly silvered optical flat and the metal surface under examination. The vertical spacings of the contours are one half the λ of the monochromatic light used. Application of the method to babbitt metal, polished and etched with 0·5% HNO_3 in EtOH, shows the acicular structure of the Cu–Sn compound to be at a level different from that of the ground-mass. The technique can be applied to the study of any process which may produce characteristic differences of level in a surface. L. S. T.

Stirring in the laboratory. H. J. PRINS (Chem. Weekblad, 1938, **35**, 236—237).—Further details of the shielded stirrer previously described (A., 1938, I, 161) are given. S. C.

Turbine stirrer. N. G. GRIGORIEV (Zavod. Lab., 1937, **6**, 1495).—A propeller stirrer is enclosed in a cylinder, which rotates together with it. R. T.

Ultracentrifuge and its field of research. (A) T. SVEDBERG. (B) E. O. KRAEMER. (C) H. S. TAYLOR (Ind. Eng. Chem. [Anal.], 1938, **10**, 113—127, 128, 129).—The development of the ultracentrifuge, its present form, the measurements which it affords, the results of protein investigations and other applications are described and illustrated.

(B) Additional applications of the low-speed centrifuge are discussed.

(C) A discussion of (A). L. S. T.

One-piece standard pipe tee piezometer ring. F. C. VILBRANDT (Ind. Eng. Chem. [Anal.], 1938, **10**, 168—169). L. S. T.

Room with a new arrangement of equipment for work on gas reactions, particularly when mercury is used as the separating liquid. A. KLEMENC (Z. Elektrochem., 1938, **44**, 243—248).—To avoid danger of poisoning by Hg vapour the room provides for (*a*) continual changing of the air, (*b*) sloping of the floor to the middle, (*c*) disposition of much equipment overhead on a bridge from which other apparatus and service mains are suspended. T. H. G.

Laboratory apparatus for continuous carrying out of high-pressure reactions. H. VOLLBRECHT (Chem. Fabr., 1938, **11**, 159—162).—The apparatus can be made for use at pressures up to 200, 400, or 800 atm., and temp. up to 500°. It is readily adaptable for reactions of practically all kinds, and is quickly made ready for use. Constructional and operating details are given. C. E. H.

Psychrometer with resistance thermometers and differential crossed-coil set-up. J. MÖLLER (Z. tech. Physik, 1938, **19**, 30—36).—Apparatus for measurement of R.H. with accuracy of $\pm 3\%$, and also for measurement of abs. humidity independent of temp., is described. O. D. S.

Apparatus for dialysis with membranes of graded porosity. A. RIEGERT (Bull. Soc. Chim. biol., 1938, **20**, 253—255). A. L.

Higher efficiency of membrane filters with porous filter plates. F. SARTORIUS (Kolloid-Z., 1938, **82**, 303).—The speed of filtration through Zsigmondy membrane filters is increased by inserting between the membrane and the perforated porcelain support a porous plate of earthenware or glass. F. L. U.

Absolute viscosimeter for anomalous liquids. V. DANEŠ (Chem. Obzor, 1937, **12**, 243—249).—With the capillary overflowing viscosimeter described, at a single filling direct measurements of flow under pressures from 0·1 cm. H_2O to 4 atm. are obtainable, the flow being measured in either a micro-pipette or gravimetrically from a const.-level overflow. Full

working details are given and figures obtained with aq. solutions of gelatin and tylose. F. R.

Differential viscosimeter. J. H. SHAXBY (J. Physiol., 1938, **91**, 19—20P). J. A. C.

Shaker for quantitative adsorption experiments. R. B. FISHER and A. E. WILHELMI (Biochem. J., 1938, **32**, 609—610).—The apparatus is effective for the shaking of suspensions in unstoppered tubes. A. L.

Micro-determination of halogen by combustion. Absorption apparatus. L. T. HALLETT (Ind. Eng. Chem. [Anal.], 1938, **10**, 111).—The new design of the absorption part of the Pregl apparatus facilitates the introduction and removal of the absorbing solution, permits the products absorbed to be removed immediately after combustion, and eliminates the necessity for drying the combustion tube. The time required for a determination is reduced by 10—15 min. L. S. T.

Improved manometer and pressure control. T. J. KILLIAN (Physical Rev., 1936, [ii], **50**, 390—391).—The apparatus described previously (A., 1937, I, 583) has been improved. Its construction and use in controlling the pressure in gaseous discharge lamps containing CO_2 are described. Characteristics and pressure range with other gases are reported. L. S. T.

Discontinuous fractional extraction apparatus utilising reflux. R. E. HERSH, K. A. VARTERESSIAN, R. A. RUSK, and M. R. FENSKE (Ind. Eng. Chem. [Anal.], 1938, **10**, 86—91).—A small-scale batch-extraction process utilising reflux for conditions where the solvent is heavier or lighter than the treated liquid is described. The apparatus is practically self-operating, and permits the separation of a liquid mixture by solvents into as many fractions as are desired. L. S. T.

[Laboratory] fractionating [distillation] apparatus for normal and reduced pressures. H. VIGREUX (Ann. Falsif., 1938, **31**, 26—28).—With the column illustrated it is possible to recover 97% of the EtOH in 0·2 of the original vol. in a single operation. E. C. S.

Nomogram for calculating percentage content of P_2O_5. E. E. ZUSSER (Zavod. Lab., 1937, **6**, 1490—1493). R. T.

Demonstration of electron-optical crystal patterns. W. G. BURGERS and J. J. A. PLOOS VAN AMSTEL (Nature, 1938, **141**, 370).—A method for demonstrating the crystal pattern of Ni and Ni–Fe activated by Sr and Ba is described. L. S. T.

Lecture experiment to demonstrate the f.p. of heavy water. E. TIEDE and H. LEMKE (Ber., 1938, **71**, [*B*], 589—590).—An apparatus, which requires projection, is figured and described. It demonstrates simultaneously the f.p. of D_2O and H_2O. H. W.

History of the Schönbein reaction, $N_2 + 2H_2O \rightarrow NH_4NO_2$. A. MITTASCH (Chem.-Ztg., 1938, **62**, 168—169).—A brief review. A. G. P.

Geochemistry.

Vertical distribution of ozone in the upper atmosphere. B. O'BRIEN, F. L. MOHLER, and H. S. STEWART (Physical Rev., 1936, [ii], **50**, 1099).—The extension of measurements reported previously (Bull. Amer. Phys. Soc., 1936, **11**, 24) to beyond the 22-km. ceiling is described. L. S. T.

Vertical distribution of ozone in the atmosphere. V. H. REGENER (Naturwiss., 1938, **26**, 155).—The O_3 content of the atm. was determined at various heights by balloon ascents. From a height of 14 km. downwards the $[O_3]$ decreased to a sharp min. between 5 and 12 km. The explanation of this is discussed. A. J. M.

Determination of atmospheric ozone at altitudes of 13 and 14 km. M. KONSTANTINOVA-SCHLESINGER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 337—338).—The $[O_3]$, determined fluorometrically, is $9{\cdot}97 \times 10^{-8}$ g. per l. C. R. H.

Differences between heavy oxygen contents of ordinary water and air. Electrolytic separation of the oxygen isotopes. N. MORITA (J. Chem. Soc. Japan, 1936, **57**, 176—179).—Atm. O_2 contains more heavy O than does the O of H_2O. The separation coeff. of the O isotopes is $1{\cdot}01 \pm 0{\cdot}01$ when aq. NaOH is electrolysed with Ni electrodes. CH. ABS. (*e*)

Dissociation, recombination and attachment processes in the upper atmosphere. I. H. S. W. MASSEY (Proc. Roy. Soc., 1937, **A, 163**, 542—553).—Collision reactions which occur in the ionised regions of the atm. are classified and their relative importance is discussed. G. D. P.

Hot springs of the Yellowstone National Park. E. T. ALLEN, A. L. DAY, and H. E. MERWIN (Carnegie Inst. Washington, Publ. 466, 1935, 525 pp.).—Comprehensive analytical data are recorded and discussed. CH. ABS. (*e*)

Physico-chemical investigations in the Primorski region of Calmuck in 1937. V. I. NIKOLAEV, O. K. JANATJEVA, and M. A. FRISCHMUT (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 345—348).—Numerous H_2O analyses are recorded and discussed. C. R. H.

Water from the Rinaggiu fountain (Temple of Pausanias). C. GASTALDI and E. PRINCIVALLE (Annali Chim. Appl., 1937, **27**, 534—538).—Chemical analyses and physico-chemical data for this H_2O from Sardinia are recorded. O. J. W.

Chemical stratification and lake morphology. G. E. HUTCHINSON (Proc. Nat. Acad. Sci., 1938, **24**, 63—69).—Determinations at 5-weekly periods of the variation with depth of the alkalinity (HCO_3') of the water of Linsley Pond, N. Branford, Connecticut, are discussed in relation to the nature of the

H_2O-movements in the hypolimnia of thermally-stratified lakes. L. S. T.

Analysis of the brine of Lake Kutschuk by a refractometric method. N. I. Visiagin and V. N. Ermin (Zavod. Lab., 1937, **6**, 1218—1220).—In sulphate or soda lakes % SO_4'' or $CO_3'' = K_1(K_2 - r)$, where K_1 and K_2 are consts. for a given lake and season, and r is the sp. refraction of the H_2O. R. T.

Exceptional temperatures of Central Atlantic water. H. B. Hachey (Science, 1938, **87**, 219—220).—Data for H_2O north of Bermuda for Aug. 28—30, 1937, are recorded. L. S. T.

Spectrographic investigation of elements existing as traces in sea-water. J. Bardet, A. Tchakirian, and (Mlle.) R. Lagrange (Compt. rend., 1938, **206**, 450—452).—Ag, Cu (0·09 mg. per l.), Ge, Mo (0·002 mg. per l.), Ni, Pb, Sn, Ti, V, W, Zn, Bi, As, and Ga have been identified spectrographically. Cu and Mo were determined colorimetrically. A. J. E. W.

Salinity of the ocean in relation to water vapour in the atmosphere and the level of the sea. E. Mencher (J. Geol., 1938, **46**, 106—108).—The salinity of the ocean plays no important part in producing changes in either atm. H_2O vapour or sea-level. L. S. T.

Chemistry of sea-water. Elements present in traces. H. Wattenberg (Z. anorg. Chem., 1938, **236**, 339—360).—A summary. F. J. G.

Liquefaction of the terrestrial globe on the assumption of an initially gaseous sphere under a polytropic law. A. Mercier (Arch. Sci. phys. nat., 1938, [v], **20**, 31—58).—Mathematical. Assuming that the earth was initially a roughly gaseous sphere of mass 6×10^{27} g., the necessary vals. of radius, temp. at the centre, and mol. wt. are discussed, and hence the distribution of density, pressure, and temp. are deduced. It is shown that if metallic vapours are distributed throughout the mass, they tend to condense in the outer crust. N. M. B.

Neon and argon in the earth's crust. (Lord) Rayleigh (Nature, 1938, **141**, 410).—Granite contains approx. 10^{-6} c.c. of Ne and 4×10^{-5} c.c. of A per g. A atoms are thus only 40 times as abundant as those of Ne instead of 520 times as in the atm. The results support the view that there has been a loss of Ne from the atm. L. S. T.

Collection of chemical analyses of minerals and rocks. I. P. Alimarin and I. I. Romm (Trans. All-Union Sci. Res. Inst. Econ. Min., U.S.S.R., 1935, No. 76, 7—62).—Analyses of 270 minerals and rocks are given. Ch. Abs. (*e*)

Effect of pressure on the rigidity of rocks. F. Birch and D. Bancroft (J. Geol., 1938, **46**, 59—87).—The velocity of torsional waves in cylinders of rock of various types (data and chemical analyses given) exposed to pressures up to 4000 kg. per sq. cm. at 30° and 100° has been measured by a dynamical method. The vals. derived for rigidity show that large changes in rigidity often occur on the application of the first few hundred atm. pressures; at high pressures, changes in rigidity with pressure become small and approx. linear. L. S. T.

Rock weathering. S. S. Goldich (J. Geol., 1938, **46**, 17—58).—Rock weathering in the granite gneiss of Morton, Minnesota, the diabase from the Medford, Massachusetts, and from Lake Superior, Minnesota, and an amphibolite from the Black Hills, S. Dakota, has been investigated by means of mineralogical and chemical analyses (recorded). The granite gneiss shows a marked loss of Na_2O and CaO in early stages, but a more gradual loss of K_2O and BaO. Kaolinite is an end product. The diabase from Lake Superior is weathered locally but shows little chemical change except oxidation. The amphibolite yielded beidellite or related clay minerals, by decomp. of its hornblende; calcite has been leached, and other minerals attacked. A mineral-stability series in weathering is proposed, and corresponds with the Bowen reaction series. Experimental attack of silicate minerals by H_2O (A., 1935, 322) is in accord with the proposed series. L. S. T.

Influence of potential in ore deposition. A. S. Dadson (Univ. Toronto Studies, Geol. Ser., 1935, No. 38, 51—60).—Niccolite, rammelsbergite, and temiskamite are quickly attacked by 0·025N-Ag_2SO_4 with pptn. of Ag. Loellingite, safflorite, smaltite, chloanthite, and skutterudite are slowly attacked, and arsenopyrite, cobaltite, gersdorffite silver, and breithauptite are not attacked. When a mineral of the first group is in contact with one or more members of the other groups an e.m.f. is set up, with pptn. of Ag on the less sol. minerals. A further subdivision of these minerals is obtained by adding 3 pts. of HF to 10 pts. of the aq. Ag_2SO_4. Ch. Abs. (*e*)

Distribution of lithium in rocks and minerals as revealed by quantitative spectrum analysis. L. W. Strock (Amer. Min., 1937, **22**, 212).—The method used is capable of determining 0·0001—3·5% Li_2O with an accuracy of ±3%. The Li_2O contents of various types of primary, sedimentary, and some metamorphic rocks have been determined. Analyses of the separate mineral components of rocks furnish an example of the way in which the laws of crystal chemistry may be applied in explaining isomorphism in minerals. L. S. T.

Possibility of determining the geological age of minerals and rocks containing rubidium. O. Hahn and E. Walling (Z. anorg. Chem., 1938, **236**, 78—82).—Mass-spectroscopic determination of ^{87}Sr fixes the geological age of Rb minerals. F. J. G.

Noble-metal content of potassium salt deposits. J. Goubeau and L. Birckenbach (Z. anorg. Chem., 1938, **236**, 37—44).—The K salts contain on the average about 1 mg. of noble metals per m. ton. The clays and rocks associated with them contain rather larger amounts, averaging 4 to 7 mg. per ton. F. J. G.

Unusual felspar from the Northern Inyo Range. G. H. Anderson and D. D. Maclellan (Amer. Min., 1937, **22**, 208).—A positive triclinic

potassic felspar different in several respects from other species is described. L. S. T.

Weathering of potash felspar. C. W. CORRENS and W. VON ENGELHARDT (Naturwiss., 1938, **26**, 137—138).—The action of very dil. acids and alkalis on powdered potash felspar, $KAlSi_3O_8$, for six months has been investigated. Solutions of p_H 0 (H_2SO_4), 3 (H_2SO_4), 6 (CO_2), 7 (CO_2-free), and 11 (NH_3) were used and the particles had radii <1 μ., and 3—10 μ. The felspar was broken down to ions, or at the most very low aggregates. The velocities with which SiO_2, Al_2O_3, and K_2O dissolve in the various solvents are different, so that the felspar particles are covered with a layer of the less sol. component, the composition of which varies with the p_H of the solvent. This layer slows down the initial velocity of dissolution to a const. val. No residual lattice of kaolinite is formed from Al_2O_3 and SiO_2, nor is a colloidal solution of SiO_2 produced. A. J. M.

Twin-laws in orthoclase crystals from Goodsprings, Nevada. J. DRUGMAN (Min. Mag., 1938, **25**, 1—14).—Material from this locality is described, and the twin-laws of orthoclase are discussed. L. J. S.

Lattice-constants and space groups of rhodizite and jeremejevite. H. STRUNZ (Naturwiss., 1938, **26**, 217).—*X*-Ray analysis gives for rhodizite $[(Na,K)_2Li_4Al_4Be_3B_{10}O_{27}]$ the space-group $T_d^2 - P\bar{4}3m$, and the lattice const. $a_w = 7{\cdot}303 \pm 0{\cdot}025$ A. Jeremejevite ($AlBO_3$) has space-group $C_{6h}^2 - C6_3/m$ and lattice consts. $a_{hex.}$ $8{\cdot}47 \pm 0{\cdot}02$ A., c $8{\cdot}09 \pm 0{\cdot}02$ A., $a : c = 1 : 0{\cdot}955$. Eichwaldite has practically the same lattice consts. as jeremejevite, but has space-group $C_{2h} - 2/m$. A. J. M.

Acmite in the riebeckite-microgranite of Mynydd Mawr, Caernarvonshire. S. R. NOCKOLDS (Min. Mag., 1938, **25**, 35—37).—Microscopic crystals, previously referred to tourmaline, hornblende, or riebeckite, in this well-known rock are now identified as acmite. L. J. S.

Zircon of low density. J. LIETZ (Z. Krist., 1937, **98**, 201—210; cf. A., 1938, I, 105; 1937, I, 382, 392).—Density and *X*-ray analyses of light zircon ($\rho \sim 4{\cdot}0$) are compared with temp. curves (by Gause) showing the variation between 0° and 1200° of ρ, n_ε n_ω, and of the angle in suitably cut 90° prisms, for Ceylon zircons of ρ 4·05, 4·28, and 4·49. Temp. curves are continuous, linear for the cooling cycle, but in the heating cycle with marked peaks or gradient increase at 900° (or less as ρ increases). In agreement with ρ and *X*-ray analyses, these are due to resynthesis from amorphous SiO_2 and microcryst. cubic ZrO_2 of $ZrSiO_4$, but with cell consts. $>$ and $\rho <$ those of normal zircon (ρ 4·7). Results of Chudoba and of Kostyleva are confirmed. Improved nomenclature is proposed. I. McA.

Zeolites. A. N. WINCHELL (Amer. Min., 1937, **22**, 206; cf. A., 1937, I, 270).—Diagrams previously used to represent variations in composition have been corr. and modified to include new data. The variation consists essentially in the addition of SiO_2. L. S. T.

Rare-alkali biotite from King's Mountain, N. Carolina. F. L. HESS and R. E. STEVENS (Amer. Min., 1937, **22**, 209).—Dark mica, developed notably in a mica schist at the contact with a pegmatite, at Tin Mountain, S. Dakota, and Winterham, Virginia, contains small amounts of Li, Cs, and Rb. Spodumene occurs in the pegmatites, enclosed in mica schists, from Kings Mountain, N. Carolina. L. S. T.

Helium ratio of Florida anhydrite. W. D. URRY (Amer. Min., 1937, **22**, 212).—The computed age, $71 \pm 6 \times 10^6$ years, agrees with stratigraphic evidence. L. S. T.

Crystallography of synthetic burkeite. L. S. RAMSDELL (Amer. Min., 1937, **22**, 213).—Crystals of $2Na_2SO_4,Na_2CO_3$, $a : b : c = 0{\cdot}534 : 1 : 0{\cdot}750$, have been obtained by evaporation from solution at 70—80°. L. S. T.

Origin of the Canadian apatite-phlogopite deposits. K. K. LANDES (Amer. Min., 1937, **22**, 213).—A discussion. L. S. T.

Boulder Co. tungsten ores. F. B. LOOMIS, jun. (Econ. Geol., 1937, **32**, 952—963).—The modes of occurrence of ferberite, the principal W mineral, and scheelite are described. The W ores appear to have been formed at a shallow depth under conditions similar to those encountered in hot springs. L. S. T.

Pegmatites south-west of Custer, S. Dakota. H. STOBBE (Econ. Geol., 1937, **32**, 964—973).—A new soda-rich felspar deposit, the Big Tom, is described. Beryl, amblygonite, and columbite are among the minerals found in this pegmatite. L. S. T.

Genesis of sulphur deposits of the U.S.S.R. F. AHLFELD (Econ. Geol., 1937, **32**, 974—976).—A discussion of the genesis of sedimentary S deposits in general. The view (A., 1937, I, 334) that reduction of SO_4'' to H_2S can be explained only by bacterial action is supported. L. S. T.

Talc deposits of N. Carolina. J. L. STUCKEY (Econ. Geol., 1937, **32**, 1009—1018).—The talc lenses, associated with marble, were probably formed by hot solutions of magmatic origin. L. S. T.

Mount Isa ore deposition. R. BLANCHARD and G. HALL (Econ. Geol., 1937, **32**, 1042—1057).—Field conditions are described and their bearing on the conclusions derived from a microscopical examination of the ores (A., 1937, I, 586) are discussed. L. S. T.

Paragenesis of pyrrhotite. H. S. SPENCE (Econ. Geol., 1937, **32**, 1058—1061).—The association of pyrrhotite with minerals, especially molybdenite, other than those mentioned by Schwartz (A., 1937, I, 270) is discussed. L. S. T.

Geology of Sule Stack, Orkney. M. STEWART (Geol. Mag., 1938, **75**, 135—140).—Sule Stack is composed of an orthogneiss, chemical analysis [H. BENNETT] given, traversed by shatter belts and small pegmatite veins of microcline and quartz. The chief minerals of the gneiss are oligoclase and

orthoclase felspars, hornblende altering towards chlorite, augite, and apatite. L. S. T.

Aluminous pyroxenes in metamorphosed limestones. C. E. TILLEY (Geol. Mag., 1938, **75**, 81—86).—Chemical analyses of aluminous pyroxenes are discussed. Fassaitic (*i.e.*, aluminous) pyroxenes are more widespread than is customarily expressed. New analyses [H. C. G. VINCENT] of both pyroxene and spinel from a pyroxene-spinel-paragenesis from Adhekanwela, Ceylon, and from Monzoni, Tyrol, are recorded. L. S. T.

Cummingtonite-bearing rocks from the Lewisian. C. E. TILLEY (Geol. Mag., 1938, **75**, 76—81).—Chemical analyses [H. G. VINCENT] of rocks from the Gairloch area are included. L. S. T.

Transfusion phenomena in lamprophyre dykes and their bearing on petrogenesis. D. L. REYNOLDS (Geol. Mag., 1938, **75**, 51—76).—Microchemical analyses [E. KROUPA] of a felspathic rim from a quartz xenolith in the Kircubbin dyke, Ards Peninsula, and in the Nowmains dyke, Dumfriesshire, and a macro-analysis [W. H. HERDSMAN] of an alkali-felspar-porphyry from Cloghy, Ards Peninsula, are recorded. L. S. T.

Disintegration and exfoliation of granite in Egypt. D. BARTON (J. Geol., 1938, **46**, 109—110).—A discussion. L. S. T.

Etive granite complex. J. G. C. ANDERSON (Quart. J. Geol. Soc., 1937, **93**, 487—533).—Chemical analyses are included. L. S. T.

Structural lattice and classification of bustamite. H. BERMAN and F. A. GONYER (Amer. Min., 1937, **22**, 215—216).—*X*-Ray analysis gives a_0 7·64, b_0 7·16, c_0 6·87 A., α 92° 08′, β 94° 54½′, and γ 101° 35′; cell content $Ca_3Mn_3Si_6O_{18}$. Bustamite is thus a Mn wollastonite. L. S. T.

Basic mica-trap dyke from the Raniganj coalfield. N. N. CHATTERJEE (Quart. J. Geol. Min. Met. Soc. India, 1937, **9**, 51—59).—The dark green rock contains a brown mica, serpentinised or chloritic material, olivine, calcite, and some felspar. A chemical analysis is given. L. S. T.

Trisoctahedral garnet from West Thetford Mines, P.Q. A. L. PARSONS (Univ. Toronto Studies, Geol. Ser., 1935, **38**, 33—36).—The crystals are associated with diopside in a kaolin-like matrix. The nucleus differs from the outer portion and consists of 4 mol. parts of andradite to 1 part of grossularite. CH. ABS. (*e*)

Iodine in some limestones. A. ERNEST (Zeměd. Arch., 1934, **25**, 481—488).—The I content of certain limestone minerals varies from 0·465 to 22·78 mg. per kg. of material. CH. ABS. (*e*)

Natrolite and epinatrolite. J. E. HIBSCH (Tsch. Min. Petr. Mitt., 1937, **49**, 459—460).—There is no good reason for regarding epinatrolite (Thugutt, 1911; A., 1932, 1229) to be different from natrolite. L. J. S.

Rhodochrosite from Trepča. L. DOLAR-MANTUANI (Z. Krist., 1937, **98**, 181—184).—Morphology and chemical analyses of an exceptional formation showing pseudomorphosis towards aragonite are discussed. I. McA.

Relation between colour and spectrochemical composition of Aliva blende (Picos de Europa). S. PIÑA DE RUBÍES and J. M. LÓPEZ DE AZCONA (Anal. Fis. Quím., 1937, **35**, 180—186; cf. A., 1936, 817).—From a qual. spectrographic study of coloured blendes it is found that the colours are due to small amounts of Co, Fe (?) (green) Sn, In, Ag (red), Mo, Ge, Ga, Cu, Hg, and Cd (yellow). In the earlier paper (*loc. cit.*) the presence of Be is recorded in error for Sr. F. R. G.

Ungemachite and clino-ungemachite. M. A. PEACOCK and M. C. BANDY (Amer. Min., 1937, **22**, 207).—Ungemachite (I), colourless, transparent, uniaxial, negative, occurs with sideronatrite in massive altered Fe sulphates at Chuquicamata, Chile. (I) is rhombohedral, $a:c$ 1 : 2·2966, α 62° 51½′, a_0 10·84± 0·02 A., c_0 24·82±0·05 A., V_0 842 cubic A., hardness 2·5, d 2·287±0·003, analysis [F. A. GONYER] Na_2O 21·61, K_2O 11·35, Fe_2O_3 7·69, SO_3 40·23, H_2O 16·69, N_2O_5 trace, insol. 2·07, total 99·64%. The unit cell contains $Na_8(K,Fe^{\cdots})_4(OH)_2(SO_4)_6,10H_2O$ with $K:Fe^{\cdots}$ approx. 3 : 1. Clino-ungemachite is monoclinic, $a:b:c$ 1·6327 : 1 : 1·7308, β 110° 40′. The simple lattice is pseudo-rhombohedral, similar to that of (I), with which it is intimately associated, and which it resembles in properties. L. S. T.

Ternary system leucite–diopside–silica. J. F. SCHAIRER (Amer. Min., 1937, **22**, 213).—The diopside (I) field occupies a large portion of the phase diagram, and (I) is the primary phase in some compositions with <2% by wt. of (I). The ternary eutectic [solid phases (I), tridymite, orthoclase (II)] and the ternary reaction point [solid phases, leucite (III), (II), and (I)] lie at compositions close to the binary eutectic and binary reaction point in the system (III)–SiO_2. The (II) field is small. Residual liquids in fractional crystallisation are rich in alkali Al silicates. L. S. T.

Natural versus artificial textures of copper arsenides. G. M. SCHWARTZ and A. C. FORSYTH (Econ. Geol., 1937, **32**, 896—905).—Photomicrographs of polished sections which reveal the contrast between natural and synthetic Cu arsenides are reproduced. Fusion of domeykite (I), algodonite, and whitneyite produces textures similar to those produced by fusing Cu and As in the proportions represented by Cu_3As, Cu_6As, and Cu_9As, respectively, but the artificial textures are unlike those in the natural minerals. Textures of artificial mixtures resulting from long periods of annealing and diffusion appear to approach more closely the textures of the natural minerals. With the exception of (I), the natural minerals do not correspond with the stability relationships indicated by the Cu–As phase diagram. L. S. T.

Origin of argillaceous rocks in the district of Confolens (Charente), attributed to the siderolite group. F. KRAUT and A. VATAN (Compt. rend., 1938, **206**, 443—445).—An examination of the rocks is described; they originate from the cryst. substratum, and are not siderolithic. A. J. E. W.

Basic plutonic rocks of the central Alps and their metamorphism. F. KÜMEL (Tsch. Min. Petr. Mitt., 1937, 49, 415—441).—Chemical analysis by J. WIDTMANN of amphibolite points to this rock having been derived from a gabbro. L. J. S.

Scawtite pseudomorphs after spurrite from Scawt Hill, Co. Antrim. C. E. TILLEY (Min. Mag., 1938, 25, 38—40).—At the dolerite–chalk contact, larnite (Ca_2SiO_4) in presence of excess of calcite passes into spurrite ($2Ca_2SiO_4,CaCO_3$) and finally into scawtite ($3CaCO_3,Ca_3Si_4O_{11}$). L. J. S.

Granular rocks associated with the ankaratrite of Takarindoha, Madagascar. A. LACROIX (Compt. rend., 1938, 206, 548—552).—Pegmatitoid rocks (cf. A., 1928, 1110) and pyroxenolite associated with ankaratrite have been studied and analysed. R. S. B.

Temperature of formation of quartz and some associated minerals. V. B. MEEN (Univ. Toronto Studies, Geol. Ser., 1935, No. 38, 61—68).—Galena, sphalerite, argentite, and chalcopyrite were formed below 575°. Au and tourmaline occur both above and below the inversion temp. Axinite, fouqueite, and scheelite crystallise below the quartz inversion temp., whilst rutile and cassiterite crystallise above it. CH. ABS. (*e*)

Unusual type of quartz. T. L. WALKER (Univ. Toronto Studies, Geol. Ser., 1935, No. 38, 31—32). CH. ABS. (*e*)

Colour of the blue quartz of the charnockites of S. India and of the opalescent quartz-gneiss of Mysore. N. JAYARAMAN (Current Sci., 1938, 6, 381—383).—The colour is due almost entirely to the existence of inclusions of a brownish-yellow turbid medium containing Ti. Acicular inclusions in the quartz consist of rutile. The turbidity and the colour of the quartz disappear on heating. The blue colour persists after removal of Fe by boiling the crushed specimens with HCl. L. S. T.

Tin ores of Banca, Billiton, and Singkep, Malay Archipelago. J. WESTERVELD (Econ. Geol., 1937, 32, 1019—1041).—A crit. discussion (cf. A., 1937, I, 382). L. S. T.

Hydrothermal leaching of iron ores. J. A. DUNN (Econ. Geol., 1937, 32, 976—977; cf. A., 1937, I, 382). L. S. T.

Valencies of iron in pyrite and marcasite. M. J. BUERGER (Amer. Min., 1937, 22, 208—209).—A redetermination of the marcasite (I) parameters using the Weissenberg methods confirms the view that (I) has a small Fe and a large S atom. Fe in pyrite (II) and in marcasite thus appears to have different valencies; (II) is Fe^{II} disulphide, and (I) is Fe^{III} disulphide. L. S. T.

Cobalt deposits in the Caucasus. G. A. KRUTOV, G. A. KREMTSCHUKOV, and N. V. BORISEVITSCH (Trans. All-Union Sci. Res. Inst. Econ. Min., 1935, No. 82, 3—71).—The deposits are described. CH. ABS. (*e*)

Magmatic differentiation as shown in the nickel-intrusive of Sudbury, Ontario. T. L. WALKER (Univ. Toronto Studies, Geol. Ser., 1935, No. 38, 23—30). CH. ABS. (*e*)

Origin of the Darwin lead–silver deposits. V. C. KELLEY (Econ. Geol., 1937, 32, 987—1008). L. S. T.

Origin of the chert in the Tri-State (Missouri–Oklahoma–Kansas) zinc–lead district. C. J. ROY (Amer. Min., 1937, 22, 214—215). L. S. T.

Origin of primary lead ores. A. KNOPF (Econ. Geol., 1937, 32, 1061—1064).—A discussion (cf. A., 1938, I, 163). L. S. T.

Paragenesis of the uranium-bearing and associated minerals of the Ruggles pegmatite near Grafton Centre, New Hampshire. B. M. SHAUB (Amer. Min., 1937, 22, 207).—Numerous U-bearing and rare-earth minerals have been discovered in this pegmatite. The uraninite is closely associated with apatite, and alteration is accompanied by a group of hydrated U-bearing phosphates. Beryl occurs sparingly. L. S. T.

Geochemistry of uranium and thorium. G. KIRSCH and F. HECHT (Z. anorg. Chem., 1938, 236, 157—164).—The ratio of Th to U, and the ratio of U^{VI} to U^{IV}, are correlated with the geological age as given by the Pb content for a no. of minerals, and their probable history is discussed in the light of the results. F. J. G.

Mineral deposits of Glacier Bay and vicinity, Alaska. J. C. REED (Econ. Geol., 1938, 33, 52—80).—Descriptive. L. S. T.

Garnets from vesicles in rhyolite near Ely, Nevada. A. PABST (Amer. Min., 1938, 23, 101—103).—A chemical analysis and physical data are recorded. L. S. T.

Kalgoorlie geology re-interpreted. F. L. STILLWELL (Econ. Geol., 1938, 33, 108—112).—A discussion (cf. A., 1937, I, 483). L. S. T.

Structural investigation of the isomorphism of the apatite group. D. MCCONNELL (Amer. Min., 1938, 23, 1—19).—Chemical, *X*-ray powder, and structural data for fluorapatite (I), francolite, dahllite, manganapatite, fermorite, dehrnite, lewistonite, wilkeite, hydroxyapatite, etc. are summarised and discussed. These are mainly isomorphous members of several complex series. The structure assigned to (I) by Náray-Szabó (A., 1931, 550) and by Mehmel (A., 1932, 218) appears to be essentially correct. The structure of apatite appears to be remarkably stable, and permits unusual types of substitution involving many ions. Several different ions can replace each of the four ions of (I). Ca is replaced by Na, K, Mn, Sr, Mg, and C; P by S, Si, As, V, and C; F by Cl, O, and OH, but not CO_3; and O by F and OH. The substitutions of C for Ca and P, and F for O and O for F, are noteworthy. The isomorphism of this group is more complicated than has hitherto been recognised. L. S. T.

Behaviour of montmorillonite at high temperatures. D. S. BELIANKIN and V. P. IVANOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, 18, 279—

282).—The dehydration curves determined for several Soviet montmorillonites are discussed and interpreted. L. S. T.

Heavy minerals in the granitic rocks of the Yosemite region. A. PABST (Amer. Min., 1938, **23**, 46—53).—Heavy mineral analyses are recorded and discussed. Zircon occurs in all of the specimens examined, and a little allanite is present in several of the more siliceous rocks. L. S. T.

Relation of leightonite to polyhalide. M. A. PEACOCK (Amer. Min., 1938, **23**, 38—45).—Leightonite is the Cu analogue of polyhalite (II). When suitably re-oriented (II) is similar to (I) in geometrical elements, habit, and twinning. The lattice is indicated as all face-centered. L. S. T.

Taeniolite from Magnet Cove, Arkansas. H. D. MISER and R. E. STEVENS (Amer. Min., 1938, **23**, 104—110).—Taeniolite (I), $KLiMg_2Si_4O_{10}F_2$, d 2·819, α 1·522, β 1·553, γ 1·553, all $\pm$0·002, has SiO_2 58·82, Al_2O_3 1·29, Fe_2O_3 0·40, FeO 0·24, MgO 19·18, CaO none, Li_2O 3·10, Na_2O 0·64, K_2O 10·44, Rb_2O none, CS_2O none, H_2O- 0·09, H_2O+ 0·59, TiO_2 0·11, F 8·56, Cr_2O_3 trace, MnO none, BaO none, total 103·46, less O for F 3·61, total 99·85%. The structural relationships between (I), talc, muscovite, and lepidolite are discussed, and their similarity is revealed by the X-ray powder photographs reproduced. Owing to the absence of essential Al, (I) is unique among the micas. The place of Al in the octahedral group is taken by Li and Mg. (I) is one of the few micas in which Si_4O_{10} constitutes the double layers, with little or no substitution by the group $AlSi_3O_{10}$. L. S. T.

Lapis lazuli from San Bernardino County, California. A. F. ROGERS (Amer. Min., 1938, **23**, 111—114).—The blue mineral of the lapis lazuli rock is a sulphide-bearing haüyne. L. S. T.

Deformation of single calcite crystals under high confining pressures. D. GRIGGS (Amer. Min., 1938, **23**, 28—33).—Ductility is increased 5·83 times and the ultimate strength 20·3 times by a confining pressure of 10^4 atm. The ductility of single crystals of calcite at high pressure is $\ll$ that of the aggregates, limestone and marble. The mechanism of deformation of single crystals does not change with pressure alone, and $10\bar{1}2$ twinning is the dominant means of deformation. L. S. T.

Osmiridium with a cubic crystalline lattice. O. E. ZVJAGINTZEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 295—297).—Auric osmiridium or aurosmirid, Ir 51·7, Os 25·5, Ru 3·5, and Au 19·3%, has the cubic lattice of Ir. A mineral, Ir 65·4, Os 31·2, Rh 1·8%, separated from Ural Pt residues also has a face-centered cubic structure (X-ray data given) with a parameter approaching that of Ir. The boundary of two solid solutions in the Os–Ir alloys thus lies between 35 and 31% Os; alloys with an Os content $>$ this have the hexagonal Os lattice, and those with less have the cubic face-centered lattice of Ir. The system of natural Os–Ir alloys should be classified: Os 0—35%, minerals of the native Ir group; Os 35—50%, nevyanskite; Os 50—70%, syssertskite. L. S. T.

Atomic packing models of some common silicate structures. J. E. DORRIS, C. FRONDEL, W. C. GÜSSOW, V. M. LOPEZ, C. S. LORD, W. PARRISH, and J. A. SHIMER (Amer. Min., 1938, **23**, 65—84; cf. A., 1936, 782).—Instructions and data for the construction of models of zircon, olivine, diopside, muscovite, and sanidine are given. Photographs of the finished models are reproduced. L. S. T.

Terrestrial aluminophosphorus and aluminosulphur analogues of kaolinic aluminosilicates. V. I. VERNADSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 287—294).—A discussion. L. S. T.

Structural relationships of kaolinites and anauxites. F. MACHATSCHKI (Amer. Min., 1938, **23**, 117—118).—A discussion (cf. A., 1937, I, 586). L. S. T.

Clay minerals in Illinois limestones and dolomites. R. E. GRIM, J. E. LAMAR, and W. F. BRADLEY (J. Geol., 1937, **45**, 829—843).—Microscopic and X-ray investigations of the clay minerals contained in the fine fraction of the insol. residues from 35 representative limestones and dolomites show the presence of illite (I) (analyses recorded) in all samples, kaolinite (II) in 20, and beidellite (?) (III) in 3. Much of the (I) is probably derived from (III), whilst the (II) is considered to be detrital. Clay mineral data are regarded as of considerable economic val. L. S. T.

Structural formulæ and classification of clays. J. DE LAPPARENT (Z. Krist., 1937, **98**, 233—258).—On a chemico-structural basis, clay phyllites (including non-Al analogues) are reviewed in 3 main groups, characterised by the thickness of the primary sheets ($\sim$7, 10, and 14 A.), and illustrated by X-ray, thermal, and chemical analyses due to Hocart and Eich, Jouravsky, and Raoult, respectively. Ionic exchange and the function of H_2O in layer mobility are considered. Attapulgites are not grouped with montmorillonites (A., 1938, I, 52). I. McA.

Micaceous minerals as clays. E. MAEGDEFRAU and U. HOFMANN (Z. Krist., 1937, **98**, 31—59; cf. B., 1935, 1060).—Though seldom present in ceramic clay and fuller's earth, micaceous minerals are widespread in the (<2 μ.) content of commercial clays. Powder X-radiograms, chemical analyses, n, and ρ are determined for seladonite, micas of Sárospatak and of Goeschwitz (I), glauconite, and Grim's "sericite-like mineral," and compared with similar data for muscovite, biotite, and neo-permutit. Quant. ion distribution in the cells, interpreted in terms of the similar muscovite structure (A., 1933, 451), is discussed. Dehydration in these minerals is marked at 350—600°. Considerable base exchange against $NH_4^{\cdot}$ is found for (I). The rôle of the micaceous constituents in accounting for the properties of clays is discussed. I. McA.

Clay. (SIR) W. BRAGG (Proc. Roy. Inst., 1938, **30**, 39—67).—A lecture.

Refractive indices of vitrains. T. T. QUIRKE and L. C. MCCABE (Amer. Min., 1937, **22**, 219).—Variations in the quality of vitrain are indicated by changes in η which range from 1·60 to $>$1·80. η was computed from the angle of max. polarisation reflected from polished surfaces and not by the oil immersion method. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JUNE, 1938.

New bands ending on the $1s\sigma 2p\sigma\,^1\Sigma_u$ state of H_2. O. W. RICHARDSON (Proc. Roy. Soc., 1938, **A**, **164**, 316—345).—Two new band systems are described extending from the yellow to the photographic infra-red limit (11,750 A.). It is concluded that they are states with both the electrons in H_2 excited. Two alternative methods of classifying the new states and seven other abnormal states as states with both electrons excited are discussed. G. D. P.

High terms of Paschen series in hydrogen and deuterium. H. NAGAOKA and T. MISHIMA (Proc. Imp. Acad. Tokyo, 1938, **14**, 53—56).—Using high dispersion and taking special precautions to reduce contamination, the existence of higher terms, hitherto masked by the secondary spectrum and lines due to O, is revealed. E. S. H.

Term values in carbon. C. W. UFFORD (Physical Rev., 1938, [ii], **53**, 568—569).—The energies of the terms of the normal state of C I, $1s^22s^22p^2$, and of the excited state $1s^22s2p^3$ are calc. with one-electron functions for a self-consistent field. Tables of radial integrals, abs. energies, and separations of the terms are given. N. M. B.

Spectroscopic investigation of the electrical oxidation of nitrogen. E. N. EREMIN, K. S. BOGOMOLOV, N. I. KOBOSEV, and S. S. VASSILIEV (J. Phys. Chem. Russ., 1938, **11**, 33—44).—The emission spectrum of a glow discharge in N_2 contains the II positive, the I positive, and the I negative group of N_2 lines. In air, in addition to these, the γ group of NO and, at pressures >70 mm. Hg, a continuum between 5400 and 6000 A. appear. The intensity of the continuum rises, and that of the bands decreases, with increasing pressure (3—500 mm.). Both intensities increase with the current strength (100—300 ma.). Most of the emission is due to excited mols., and only 1·5—4% to excited ions. J. J. B.

High-pressure afterglow in nitrogen. J. KAPLAN (Nature, 1938, **141**, 645—646).—An intense N afterglow has been produced at pressures >10 mm. There is a relatively strong excitation of the Vegard-Kaplan intercombination bands, and a strong line at 3470 A., which is tentatively identified as the hitherto unobserved at. N line ^2P—^4S (cf. A., 1938, I, 219). L. S. T.

Presence of sodium in the upper atmosphere. J. CABANNES, J. DUFAY, and J. GAUZIT (Compt. rend., 1938, **206**, 870—872; cf. A., 1938, I, 166).—Interferometric examination of the yellow line in the spectrum of the twilight sky shows this line to consist of the D_1D_2 doublet of Na. At night the intensity of the line corresponds with approx. 10^{11} $3p^2P$—$3s^2S$ Na atom transitions per sec. per cu. m. of the atm. A. J. E. W.

Interferometric study of the yellow radiation, λ 5893 A., of the sky at twilight; proof of the presence of sodium in the upper atmosphere. R. BERNARD (Compt. rend., 1938, **206**, 928—930; cf. A., 1938, I, 166, and preceding abstract).—The D_1 and D_2 lines, in the normal intensity ratio, have been interferometrically identified in the twilight sky spectrum. This indicates either an extended belt containing Na vapour, which gives rise to photo-luminescence in a max. temp. region 60 km. above the earth's surface, or a thin layer at the same height in which the Na is conc. The absence of Na lines in spectra of the aurora borealis, originating at heights >70 km., supports the latter view. A. J. E. W.

Possible presence of certain lines of the neutral sodium atom in the spectrum of the night sky. G. DÉJARDIN (Compt. rend., 1938, **206**, 930—933).—The λλ of 12 lines in the spectrum correspond closely with the first members of the $2P$—nS and $2P$—nD series of Na. A group of lines corresponding with the forbidden $2P$—nP transitions is also observed. The occurrence of Na in the atm. is discussed. A. J. E. W.

Intensity variations of the *D* line of sodium in the spectrum of the light from the sky at twilight. R. BERNARD (Compt. rend., 1938, **206**, 1137—1140). H. J. E.

Hyperfine structure and nuclear moments of aluminium. D. A. JACKSON and H. KUHN (Proc. Roy. Soc., 1938, **A**, **164**, 48—61).—The resonance lines are investigated by absorption in an atomic beam of Al. The line $3^2P_{\frac{1}{2}}$—$4S_{\frac{1}{2}}$ (λ = 3944 A.) has three components, $3^2P_{\frac{1}{2}}$—$3^2D_{\frac{3}{2}}$ (3082 A.) two. The observed intensity ratio of the latter gives a val. 9/2 for the nuclear spin. Two other lines (6696 and 6699 A.) were observed in emission and found to be doublets. G. D. P.

Absorption spectrum of sulphur at high temperatures and pressures. B. ROSEN and L. NEVEN (J. Chim. phys., 1938, **35**, 58—68; cf. A., 1937, I, 103).—Although the data support the conclusion, drawn from data at low temp. and pressures, that the vapour consists of mols. of S_2, the existence of a superimposed continuous band can only be explained by the existence of mols. of S_x (x >2). C. R. H.

Emission band spectrum of chlorine (Cl_2^+). A. ELLIOTT and W. H. B. CAMERON (Proc. Roy. Soc.,

1938, **A**, **164**, 531—546; cf. A., 1937, I, 271).—Wave nos. are tabulated; vibrational and rotational analyses have been made and it is shown that the bands belong to a doublet system. The carriers of the spectrum are ionised Cl_2 mols. Vals. of the chief mol. consts. of $(^{35}Cl_2)^+$ are given. Many of the bands do not fit into the doublet system and it is likely that a second system has its origin near the first one. The energy of dissociation of the lower state of the doublet bands is > that calc. for the normal state of Cl_2^+ from mol. and at. ionisation potentials and from the heat of dissociation of the normal state of neutral Cl_2.

G. D. P.

First spark spectrum of manganese. C. W. CURTIS (Physical Rev., 1938, [ii], **53**, 474—481).—Using a hollow-cathode discharge and He as conducting medium for the whole range 800—6200 A., and A and Ne for certain regions, the spectrum of Mn II was photographed. Full data and classifications for >700 lines are tabulated. N. M. B.

***L* spectrum of iron.** J. FARINEAU (Compt. rend., 1938, **206**, 1011—1012).—The $L\alpha$ line has max. intensity at 17·53 A., its limits being 17·51 and 17·64 A. The $L\beta$ line has a similar form, with max. intensity at 17·18 A. The no. of electrons per atom in the N_1 level, deduced from the observed widths of these lines, is 0·6 instead of 0·22 given by magnetic measurements. The discrepancy is probably due to the Auger effect, which accounts for an increase of approx. 50% in the normal width of the lines.

A. J. E. W.

Arc spectrum of indium, In I. F. PASCHEN (Ann. Physik, 1938, [v], **32**, 148—154).—λλ from 9170 to 2180 A. have been measured and are tabulated. The fine structure of the groups $5^2P_j - 4P^*_j$ has been measured. The analysis of the spectrum is discussed.

O. D. S.

Spectral distribution of the white light obtained by electrical excitation of xenon. F. GANS (Compt. rend., 1938, **206**, 1009—1011; cf. A., 1937, I, 336).—The energy distribution in the continuous spectrum given by Xe and Xe–Ne tubes (cf. A., 1937, I, 103 for method of excitation) is approx. that in the radiation of a black body at 3800°. The proportion of blue light increases with the energy dissipated in the positive column. In both Xe and Xe–Ne tubes the lines observed in the spectrum are arc lines of Xe; the intensity of the lines relative to the continuum also increases with increasing dissipation of energy in the positive column.

A. J. E. W.

First spark spectrum of cæsium. R. RICARD (Compt. rend., 1938, **206**, 905—906; cf. A., 1933, 200; 1938, I, 108).—λλ, comparative intensities, and proposed classifications of 19 new lines in the range 4270—5410 A. are recorded, and νν of 17 new electronic levels are given. Possible transitions must involve simultaneous excitation of two 5*p* electrons.

A. J. E. W.

Width of the mercury line λ 2536·7 A. G. P. BALIN (Physikal. Z. Sovietunion, 1937, **12**, 701—728).—The width of the Hg resonance line λ 2536·7 A. has been investigated by the absorption method at a pressure of 7·3 mm. Finite thickness of the emitting layer and diffuse reflexion are taken into account in estimating the form and shape of the line.

J. A. D.

Shape of mercury lines. V. FABRIKANT and F. BUTAEVA (Physikal. Z. Sovietunion, 1937, **12**, 761—763).—The shape of the line λ 4358 A. emitted by a high-pressure quartz Hg-vapour lamp at 10—20 atm. is measured. The line shows self-reversal which diminishes with increase in pressure while the broadening and shift increase. The mechanism of self-reversal at high pressure is different from that at low pressure. Conditions favourable for reversal are discussed. J. A. D.

Width of spectral lines in the high-pressure mercury discharge. R. ROMPE and P. SCHULZ (Z. Physik, 1938, **108**, 654—667).—The width of a series of Hg lines from a high-pressure Hg lamp has been examined by a spectrophotometric method and the resultant broadening of the terms calc. The 2^1P_1 term shows a large unsymmetrical broadening associated with the high pressure, due to resonance interaction and collisions of the second order. Broadening of the $^1S_0$ state is negligible but the 3^1D_2 and 3^3D_2 terms undergo symmetrical broadening through electron collisions. Unsymmetrical broadening of lines of the triplet system probably results from "static" influences in the sense of the theories of Margenau and Kuhn. H. C. G.

***Lα* satellites for element 82 (Pb).** M. VALADARES and F. MENDES (Compt. rend., 1938, **206**, 744—746).—λλ and proposed classifications of nine $L\alpha_1$ satellites are recorded. The $L\alpha_2$ system shows complex structure on the short-λ side. A. J. E. W.

Light-excitation by particles of low velocity. A. KOTECKI (Z. Physik, 1938, **108**, 640—653).—Apparatus and method are described for the measurement of light-excitation by collision of H particles with H_2, Hg, A, and He, and of ionised A with H_2 and Hg. A low-voltage capillary arc was used as the source of ions, which were then given an energy of 1000—6000 v. The light resulting from collisions was examined and the results are used to confirm Döpel's working hypothesis. H. C. G.

Mutual light-excitation from atomic impact of helium or hydrogen on beryllium, magnesium, calcium, strontium, and barium. K. GAILER (Z. Physik, 1938, **108**, 580—591).—The above effect is studied by means of He and H canal rays impinging on roughened Be and Ca metals, and the oxides of Be, Ca, Sr, and Ba, supported on a Cu plate. The latter is positively charged to 2000 v. to hinder excitation due to electrons arising from the impact. The validity of the "impact model" of Döpel is confirmed. In such at. impacts, excitation of the alkaline-earth metals alone occurs, although the kinetic energy of the impinging partner exceeds the energy of excitation of He or H. L. G. G.

Continuous *X*-ray spectrum near the Duane–Hunt limit. E. BRUNNER (Physical Rev., 1938, [ii], **53**, 457—459).—The effect on the distribution of energy in the continuous *X*-ray spectrum near the Duane–Hunt limit of the extranuclear electrons in the atoms composing the target of the *X*-ray tube is

examined theoretically. Resonance effects explain the inflexion found by Du Mond (cf. A., 1937, I, 214) in the isochromat very close to the threshold. N. M. B.

Comparison of intensities of spectral lines. D. Foster and H. W. Highriter (Physical Rev., 1938, [ii], 53, 673—674).—In using a rotating logarithmic or stepped sector disc, errors arise from the variation of intensity of a given line along the length of the arc, and the effect varies from line to line. The difficulty is overcome by a simple method of illuminating the slit. N. M. B.

Spectrum of Nova Herculis in the visual region. N. T. Bobrovnikoff (Proc. Amer. Phil. Soc., 1935, 75, 717—753).—Data are given. Ch. Abs. (e)

Admixtures and breakdown potential of argon. S. K. Moralev (Physikal. Z. Sovietunion, 1937, 12, 667—684).—The breakdown voltages of pure A and the mixtures A–N_2, A–H_2, and A–Hg have been studied. It was found that 0·1% of N_2 has no influence on the breakdown voltage of A whereas 0·1% of H_2 decreases the breakdown voltage near its min. val., but increases it at p.d. >60 v. Hg in A increases the breakdown voltage. Traces of N_2 and H_2 in the presence of Hg vapour change the breakdown voltage. J. A. D.

Quantitative measurements on high-current condensed discharges in hydrogen at low pressures. E. Blum (Ann. Physik, 1938, [v], 31, 585—599).—Methods are described for the measurement of the max. increase or decrease of current during the discharge of a condensed spark and of the time occupied by the discharge. The variation with potential, tube dimensions, and circuit resistance of the max. current and max. increase and decrease of current in a discharge through H_2 at 5 to 500 Torr pressure has been investigated and is discussed. O. D. S.

Periodic deviation from the Schottky line for tungsten. R. L. E. Seifert and T. E. Phipps (Physical Rev., 1938, [ii], 53, 493).—A reinvestigation of the thermionic emission of W for the temp. range 1560—1940° K. and field range at the filament surface 1800—260,000 v. per cm. gave results which, when plotted, show a small consistent fluctuation about the mean Schottky line. This was found to be independent of any inherent condition in the cell or circuit. N. M. B.

Temperature variation of the work function of clean and of thoriated tungsten. A. L. Reimann (Proc. Roy. Soc., 1937, **A**, 163, 499—510).—By measurement of contact p.d. information is obtained concerning the variation with temp. of the work function of clean and fully activated thoriated W. The temp. coeffs. of the two work functions are the same; that for clean W is approx. that which will account for the observed val. of the thermionic const. on the assumption of practically perfect transmission. The small val. of this const. for W–Th is ascribed to internal reflexion. G. D. P.

Photo-electric and thermionic investigations of thoriated tungsten surfaces. A. King (Physical Rev., 1938, [ii], 53, 570—577).—The expected difference of temp. dependence of the thermionic and photo-electric work functions for a non-uniform surface was found. A simple patch theory leads to the following results: the saturation electron emission is independent of the size of the patches; the observed or characteristic work functions for composite surfaces are different at low temp. and approach each other at high temp.; the max. and min. vals. of the work function for a given surface do not vary linearly with temp. N. M. B.

Force on the cathode of a copper arc. R. M. Robertson (Physical Rev., 1938, [ii], 53, 578—582; cf. A., 1930, 832).—The force, studied as a function of pressure, for the Cu arc in N_2 remains of the order of magnitude of the vals. observed in air down to about 5 mm. pressure and then increases sharply but smoothly to the much larger vals. observed in vac. Various aspects of the arc in this transition region are examined, and force–current curves at various pressures of H_2 and N_2 are given. A brief study of the stability of the vac. arc and a summary of various explanatory theories are included. N. M. B.

Energy balance for an infinitely small electron current in a uniform electric field. F. M. Penning (Physica, 1938, 5, 286—297).—Theoretical. The proportions of the energy associated with the electron current which are lost in elastic collisions, ionisation, excitation of electronic and vibrational levels, and in increasing the kinetic energy of the electron stream, are calc., electron currents in Ne, A, Ne–A mixtures, N_2, and H_2 being considered. A. J. E. W.

Most probable values for the electron charge and connected constants for 1938. R. A. Millikan (Ann. Physik, 1938, [v], 32, 34—43).—$e = 4{\cdot}796 \pm 0{\cdot}005 \times 10^{-10}$ e.s.u., $h = 6{\cdot}610 \pm 0{\cdot}012 \times 10^{-27}$ erg sec., $N = 6{\cdot}097 \pm 0{\cdot}006 \times 10^{23}$. O. D. S.

Relativistic variation of electron mass. C. T. Zahn and A. H. Spees (Physical Rev., 1938, [ii], 53, 511—521; cf. A., 1938, I, 223).—An analysis of the unmodified Bucherer–Neumann experiment reveals the possibility of serious errors. An examination of similar experiments designed to distinguish between Abraham and Lorentz electrons indicates that, at least for higher velocities, no satisfactory distinction has yet been made by direct electric and magnetic deflexion methods. N. M. B.

Characteristic energy of the electron. A. Mercier and T. Gustafson (Compt. rend., 1938, 206, 1217—1219).—Mathematical. A. J. E. W.

Relativity, resonance, and molecular diffusion. C. E. Guye (Compt. rend., 1938, 206, 961—964).—Experimental verification of the principle of relativity is discussed. A. J. E. W.

Polarisation of the light emission of positive rays. H. Angenetter and H. Verleger (Physikal. Z., 1938, 39, 328—332).—The polarisation of the spectral lines in the emission of positive rays of Li, Na, Ne, A, and Hg has been shown to be a general property of the atom. The extent of the polarisation depends on the series formula of the line, and thus on the two electronic states giving rise to the line. The polarisation, $I_{\text{parallel}}/I_{\text{perp.}}$, may be <1. A. J. M.

Against the existence of heavy β-particles. (A) Cloud chamber evidence. (B) Further evidence. A. Ruark and C. C. Jones (Physical Rev., 1938, [ii], **35**, 454—456, 496).—(A) A study of cloud chamber photographs of collisions of Ra-*E* β-particles with electrons shows that Jauncey's hypothesis of heavy β-particles disagrees with experiment.

(B) The interpretation of various available data is opposed to the existence of heavy β-particles.

N. M. B.

Theory of electron showers in multi-grid tubes. W. Schottky (Ann. Physik, 1938, [v], **32**, 195—204).—A theory for the irregular variations produced in the electron stream by a grid with positive fore-potential placed in front of the anode of a multi-grid tube is developed. O. D. S.

Theory of electron diffraction. I. E. Lamla (Ann. Physik, 1938, [v], **32**, 178—189).—The dynamic theory of von Laue is developed to take into account the interaction of > two rays. The Kikuchi envelopes can be explained as due to incoherent scattering of electrons by atoms in surface layers. O. D. S.

Signs of the nuclear magnetic moments of ^{6}Li and ^{41}K. J. E. Gorham (Physical Rev., 1938, [ii], **53**, 563—567).—Non-adiabatic transitions between magnetic quantum states in an at. beam showed that the nuclei of ^{6}Li and ^{41}K have positive magnetic moments. N. M. B.

New classification of the elements. M. Oswald (Compt. rend. XVII Cong. Chim. Ind., 1937, 26—43).—A new form of the periodic classification is put forward. The periods are lettered *K*, *L*, *M*, etc., according to which electron level in the atom is filling up, and the table is based on the electronic structure of the atoms. The table in this form is of use as a guide in the separation of the rare earths, and to the elements which may be used with C in the prep. of electrodes for arcs suitable for special purposes. A. J. M.

Disintegration of the deuteron by α-particles. H. L. Schultz (Physical Rev., 1938, [ii], **53**, 622—628).—Using Ra-*C'* and Th-*C'* α-particles to bombard a gaseous target of D_2, and a BF_3-filled ionisation chamber surrounded by paraffin and connected to a thyratron recording system to detect emitted neutrons, the non-capture disintegration of the deuteron ($^2_1H + ^4_2He \rightarrow ^1_1H + ^1_0n + ^4_2He$) has been observed. Mean cross-sections are $0{\cdot}12 \times 10^{-26}$ and $0{\cdot}30 \times 10^{-26}$ sq. cm. for the range intervals 5·7—6·9 and 7·4—8·6 cm., respectively. N. M. B.

Unknown natural α-radiation. E. Føyn and I. T. Rosenqvist (Tids. Kjemi, 1938, **18**, 64—65).—Radioactive HCl-insol. impurities in commercial Zn have been examined by a new method in which the whole apparatus is placed in a vac. Th, Ra-Th, and Th-*X* have been identified by their α-radiation. A feeble α-radiation (absorbed by 15 μ. Al), previously unknown, is possibly derived from Ma. The Th/radio-Th ratio may be used to determine the age of the Zn ore. M. H. M. A.

Counting α-particles by their photographic action. F. Halbwachs (J. Phys. Radium, 1938, [vii], **9**, 125—128).—The impressions left on a photographic plate by a bundle of α-rays have been studied. A technique of development has been adopted whereby the particles are counted individually. The method has been applied to determine the ratio of α-rays from Th-*C* and Th-*C'*. W. R. A.

Ionisation produced by certain α-ray sources used in radio-chemistry. W. Mund and C. de Vos (Bull. Soc. chim. Belg., 1938, **47**, 149—161).—Direct determination of the max. ionisation produced by a small, thin-walled tube containing Rn gives results in agreement with calculations based on tables due to Capron *et al.* (A., 1933, 762). A method of calculating the ionisation produced in the interior of a spherical vessel with the Rn tube at its centre is developed. A. J. M.

Determination of the upper energy limit of the β continuous spectrum of radioactive elements by the method of absorption. (Mlle.) A. Baschwitz (J. Phys. Radium, 1938, [vii], **9**, 120—122).—The conditions of application of the method of absorption for determining the upper energy limit of the β continuous spectrum of natural radio-elements have been investigated. The method is applicable for those elements which do not strongly emit γ-radiation. Results are also given for the radioactive forms of Sb, I, Eu, Dy, Au, and Ag.

W. R. A.

Continuous β spectra of natural radioactive elements. M. Lecoin (J. Phys. Radium, 1938, [vii], **9**, 81—95).—The continuous β spectra of several natural radioactive elements have been determined by the method of Wilson. The β-rays, varying from 600 to 2000, were photographed stereoscopically to eliminate errors due to irregularities in curvature. The results were compared with the theory of Konopinski and Uhlenbeck following the procedure of Kurie. The mean energy evolved by each disintegration and the relation between the radioactive const. and the different characteristics of the continuous spectra are discussed. W. R. A.

Canalisation of γ-rays. F. L. Hopwood and T. E. Banks (Nature, 1938, **141**, 687).—A curve showing the canalisation effect of an Fe tube on γ-rays from Ra-*B* + *C*, filtered by 0·5 mm. of Pt, is given. L. S. T.

Diffraction spectrography of γ-rays from actinium and its products. M. Frilley (Compt. rend., 1938, **206**, 1013—1015).—λλ of fluorescence lines attributed to elements 81—84, 86, and 88 are in good agreement with measurements by Ingelstam on the *K* spectra; lines due to actinon predominate. The λλ of nuclear lines between 30 and 125 X are in accord with the β-ray spectra (A., 1937, I, 275); poorer agreement is found for λλ >175 X. New lines at 51·5 and 247·5 X, attributed to radio-Ac, are reported. A. J. E. W.

Analysis of γ-rays of radium-*E*. J. A. Gray and J. F. Hinds (Canad. J. Res., 1938, **16**, **A**, 75—76).—The absorption curve of γ-rays in Al has been determined. E. S. H.

Radioactivity of potassium. A. Bramley and A. K. Brewer (Physical Rev., 1938, [ii], **53**, 502—505).—In view of discordant available data the

radioactivity of K was measured with a Geiger counter by placing a thick layer of KCl under a thin Al window. Results, corr. for the relative abundance of ^{40}K, are: disintegration const. $1{\cdot}56\pm0{\cdot}6 \times 10^{-17}$, half life $14{\cdot}2\pm3{\cdot}0 \times 10^{8}$ years. N. M. B.

Disintegration periods of the radiosilvers. A. Moussa and (Mlle.) H. Laurent (Compt. rend., 1938, **206**, 1015—1017; cf. A., 1937, I, 544).—$^{110}_{47}$Ag and $^{108}_{47}$Ag, produced by bombardment of Ag with slow neutrons from a Rn–Be source, have life-periods of 24 ± 2 and 150 ± 2 sec., respectively. The relative intensities under the conditions given show that the existence of $^{108}_{47}$Ag must be allowed for in neutron absorption experiments. A. J. E. W.

Determination of Eve's constant. R. Schulze (Ann. Physik, 1938, [v], **31**, 633—660).—Conditions for the abs. determination of Eve's const. K are discussed and defined. The val. $K = (5{\cdot}5\pm0{\cdot}1) \times 10^{9}$ ion pairs per cm. per g. Ra per sec. is obtained by experiment under these conditions and agrees with corr. vals. from earlier determinations. O. D. S.

The universal length which enters into the theory of elementary particles. W. Heisenberg (Ann. Physik, 1938, [v], **32**, 20—33).—It is shown that the introduction of a universal const. with the dimensions of a length will resolve divergences in the theory of β-decomp. and of high-energy collisions between particles. O. D. S.

Nuclear isomers of ^{116}In. A. C. G. Mitchell and L. M. Langer (Physical Rev., 1938, [ii], **53**, 505—510; cf. A., 1937, I, 594).—The isomeric periods of ^{116}In, 13 sec. and 54 min., produced by the capture of slow neutrons by ^{115}In, were studied to determine the energy level scheme of ^{116}In. The 1·4 m.e.v. γ-ray (cf. A., 1937, I, 489) has a period of 54 min. No γ-ray of 13 sec. period could be found. The % transmission by B of resonance neutrons was measured, and is the same for both periods. The branching ratio is independent of the method of excitation and has the val. $1{\cdot}12\pm0{\cdot}06$. An energy level diagram accounting for all the experimental facts is constructed. The two excited levels of ^{116}In from which disintegration takes place are separated by 0·3 m.e.v. γ-Ray transitions between these two levels can be forbidden by choosing quantum nos. differing by 5 units. N. M. B.

Bombardment of different substances by slow neutrons and the comparison of the radioactive intensities obtained. (Mlle.) A. Baschwitz (J. Phys. Radium, 1938, [vii], **9**, 123—124).—Under controlled conditions the intensities of substances rendered radioactive by bombardment with slow neutrons have been determined; from these results the order of magnitude of the intensities which would be obtained under other conditions can be ascertained. W. R. A.

Diffusion of monokinetic neutrons through protons. B. Pontecorvo (Compt. rend., 1938, **206**, 1003—1005).—The mean free path in paraffin of neutrons produced by bombarding D_2O with γ-rays from radio-Th is 1·3 cm. This gives a val. of the effective cross-section which is in agreement with the Bethe–Bacher formula. A modification of the val. of $|E_1|$, the energy of the state in which the proton and neutron spins are antiparallel, from 120,000 to ~ 90,000 ev. is proposed. A. J. E. W.

Neutron yield from Ra-γ + Be. V. Dementi, A. Leipunski, and V. Maslov (Physikal. Z. Sovietunion, 1937, **12**, 764—765).—The total no. of neutrons from Be excited by a Ra γ-ray source is measured and the cross-section for absorption of photo-neutrons in Rh and Ag is estimated. J. A. D.

Albedo of slow neutrons. E. Fermi, E. Amaldi, and G. C. Wick (Physical Rev., 1938, [ii], **53**, 493; cf. A., 1937, I, 58) —A discussion of criticisms by Halpern (cf A., 1938, 1, 112). N. M. B.

Use of an ionisation chamber with a liquid dielectric for the study of neutrons. L. Goldstein and A. Rogozinski (Compt. rend., 1938, **206**, 835—837).—Measurements of the absorption coeffs. of Pb and paraffin wax for γ-rays and neutrons from a Ra-Ac–Be source, made with an ionisation chamber filled with C_6H_{14}, show that such a chamber is an effective detector of neutrons. The ratio of the ionisation currents for γ-rays and neutrons passing through 7 cm. of Pb (39 : 61) is in agreement with the val. obtained with a N_2-filled ionisation chamber. A. J. E. W.

Production of neutrons by bombardment of beryllium with α-particles. T. Bjerge (Proc. Roy. Soc., 1938, **A**, **164**, 243—256).—Excitation curves for neutrons and γ-rays are determined experimentally. The process $^{9}_{4}\mathrm{Be} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{12}_{6}\mathrm{C} + {}^{1}_{0}n$ accounts for the presence of groups of neutrons with energies of several million ev. The $^{12}_{6}$C is left in an excited state and emits a γ-quantum. Another process gives a group with energies of ~100,000 ev. G. D. P.

Minimum neutron energy to produce neutron loss process and its application to the measurement of Q values. R. Sagane (Physical Rev., 1938, [ii], **53**, 492; cf. Pool, A., 1937, I, 490).—Data for min. neutron energy to produce the neutron loss process for several elements bombarded by neutrons of known max. energy are reported and the calculation of the max. energy of neutrons from various targets subjected to deutcron bombardment is discussed. N. M. B.

Energy of the neutrons from the disintegration of carbon by deuterons. T. W. Bonner (Physical Rev., 1938, [ii], **53**, 496—497; cf. A., 1936, 1174).—The corr. energy of the neutrons calc. from new range–energy curves of low-energy recoil protons is $0{\cdot}46\pm0{\cdot}03$ m.e.v. for neutrons observed at 90° recoiling to the 0·88 m.e.v. deuterons, and the calc. energy of disintegration is $-0{\cdot}25\pm0{\cdot}05$ m.e.v. N. M. B.

Wilson chamber study of the neutro-electric effect. S. Kikuchi and H. Aoki (Nature, 1938, **141**, 645).—Photographs of 10,538 proton tracks, 6448 using D–D neutrons and 4090 using Li–D, show only 3 paired tracks in each case. This is < that obtained previously (A., 1938, 1, 169), and is approx. one sixth of the no. expected on the basis of the neutro-electric effect. L. S. T.

Cross-sections of the deuteron for the electric and magnetic nuclear photo-effect. H. von

HALBAN, jun. (Nature, 1938, **141**, 644—645).—The cross-section of the deuteron for the total photo-effect for 2·64 m.e.v. γ-rays is $9\pm0\cdot8 \times 10^{-28}$ cm.^{2} An upper limit of 6×10^{-29} cm.^{2} is indicated for the magnetic effect; this val. is $\ll$ that derived from the capture cross-section of protons for thermal neutrons. L. S. T.

Cross-sections of interaction in reactions between very light atomic nuclei. S. FLÜGGE (Z. Physik, 1938, **108**, 545—579).—Collisions between two at. nuclei, containing between them up to four elementary particles, are considered theoretically. A method for calculating cross-sections of interaction is evolved on the assumptions that collisions are elastic and that a deuteron in combination with a neutron or proton approx. retains its shape. Results obtained are $\sim10^{-24}$ cm.^{2} and are somewhat $<$ those derived from experiment. The angular distribution for the scattering of protons of 830 kv. energy by deuterons is calc. and compared with the experiments of Tuve *et al.* (A., 1936, 539). The D + D reaction is considered in detail as being the simplest nuclear transformation involving four elementary particles. H. C. G.

γ-Radiation from boron bombarded by protons. W. A. FOWLER, E. R. GAERTTNER, and C. C. LAURITSEN (Physical Rev., 1938, [ii], **53**, 628—636; cf. A., 1937, I, 212).—Using a Wilson cloud chamber, the energy distribution of pairs and recoil electrons ejected from Pb and C laminæ by the γ-radiation from B bombarded by protons was determined. Both the pair and electron distributions indicate prominent γ-ray components at $4\cdot3\pm0\cdot3$, $11\cdot8\pm0\cdot5$, and $16\cdot6\pm0\cdot6$ m.e.v., with relative intensities 7 : 7 : 1, respectively. The radiation is probably due to proton capture by ^{11}B to form an excited state of ^{12}C which radiates in a single transition to the ground state or in a double transition through the intermediate state at 4·3 m.e.v. N. M. B.

Boron + proton reactions. J. R. OPPENHEIMER and R. SERBER (Physical Rev., 1938, [ii], **53**, 636—638).—Evidence on the ^{11}B + ^{1}H reactions and their interpretations show that a satisfactory description cannot be obtained on the assumption that the same resonance level of ^{12}C is responsible for the 16 m.e.v. γ-ray (cf. preceding abstract) and for the long-range α-particle (cf. Neuert, A., 1937, I, 161). N. M. B.

Energy of the proton groups emitted during transmutation of boron by α-rays. F. JOLIOT and I. ZLOTOWSKI (Compt. rend., 1938, **206**, 750—752).—Results obtained from Wilson cloud-chamber photographs of the proton trajectories in a magnetic field are recorded. Using a Po α-ray source, the max. observed val. of Q is 4·3 m.e.v., in accord with the val. calc. using Oliphant's at. masses. A new proton group with $Q = 2\cdot0\pm0\cdot3$ m.e.v. is reported. There is no evidence of a group with $Q = 3\cdot1$ m.e.v. (cf. A., 1936, 1045). A. J. E. W.

Resonance transmutations of carbon by protons. P. I. DEE, S. C. CURRAN, and V. PETRŽÍLKA (Nature, 1938, **141**, 642—643).—Investigation of the γ-ray emission of C bombarded by protons shows two resonances at approx. 470 and 560 kv. For 560-kv. protons, the γ-ray energy is 7·4 m.e.v., and this peak must be ascribed to the formation of stable ^{14}N from ^{13}C. For the 470-kv. protons the γ-ray energy observed is 2·6 m.e.v. and the peak at 470 kv. must be attributed to the formation of radioactive ^{13}N from ^{12}C. L. S. T.

γ-Radiation from ^{13}N. J. R. RICHARDSON (Physical Rev., 1938, [ii], **53**, 610).—Distribution curves for the photo-electrons ejected from Pb by the γ-radiation from ^{13}N showed two groups of tracks. Results indicate 2·5 quanta of 0·5 m.e.v. radiation per quantum of 0·3 m.e.v. radiation, or 0·8 quantum of 0·3 m.e.v. radiation for every positron emitted by ^{13}N. A Pb radiator is more sensitive than one of low at. no. in the low-energy region. A similar investigation of the radiation from ^{61}Cu and from a thin source of ^{13}N arranged so that most of the positrons were annihilated behind the Pb shield indicated that the radiation is probably nuclear in origin. Reaction mechanisms are discussed. N. M. B.

Shape of the β-ray spectrum of ^{32}P. E. M. LYMAN (Physical Rev., 1936, [ii], **50**, 385). L. S. T.

Radioactivity induced by neutrons in ruthenium. H. DE VRIES and J. VELDKAMP (Physica, 1938, **5**, 249—256).—Periods of 45 sec. and 4 min. induced by slow and fast neutrons (cf. Kurtschatow, A., 1935, 1050) are due to Rh present as impurity. With slow neutrons periods of 4 hr., 20 hr., and 45 days are also found; they are ascribed to ^{103}Ru, ^{105}Ru, and ^{105}Rh, respectively, the last giving rise to a chain reaction. The 39-hr. period observed with deuteron bombardment (Livingood, A., 1936, 1315) is probably due to the 20-hr. period with another deuteron-induced period superimposed. The 20-min. and 4-hr. periods induced by fast neutrons (A., 1937, I, 490) are confirmed. These results are discussed in relation to an isotope diagram for elements 44—49. Relations between the decay curve and the decay consts. for elements forming a chain process are discussed; it is shown that when $\lambda_1 > 2\lambda_2$, the simple exponentials into which the decay curve can be resolved have an extrapolated intensity ratio of $(\lambda_1 - 2\lambda_2) : \lambda_2$. A. J. E. W.

Isomerides of radio-indium. M. L. POOL (Physical Rev., 1938, [ii], **53**, 611—612; cf. A., 1937, I, 594).—Available data are used to calculate the branching ratios for the periods involved. The abundance ratio ^{115}In : ^{113}In is 21·2. ^{112}In is an isomeric nucleus having two decay periods, 72 sec. and 4·1 hr., and abundance ratio approx. 2·0. Mechanisms are discussed. N. M. B.

Electron capture and internal conversion in ^{67}Ga. L. W. ALVAREZ (Physical Rev., 1938, [ii], **53**, 606; cf. A., 1937, I, 487).—Evidence is given that ^{67}Ga transforms into ^{67}Zn by electron capture and then emits a K X-ray quantum in half of the cases. The excited state of the ^{67}Zn then emits either or both a 100 kv. and a 0·2—0·3 m.e.v. γ-ray quantum, the 100 kv. line being highly internally converted. Finally another 0·5 quantum of Zn K radiation is emitted. N. M. B.

Radioelement of period 3·5 hours formed in uranium irradiated by neutrons. (Mme.) I. Curie and P. Savitch (Compt. rend., 1938, **206**, 906—908; cf. A., 1937, I, 423).—The element, which is formed directly from U by slow or fast neutron bombardment, is not an isotope of Th (cf. A., 1938, 1, 9), as it can be separated from U-*X* with La. The chemical properties indicate that it is either an isotope of Ac, or a new trans-uranian element. The saturation intensity is about a quarter of that of the element of period 16 min. formed under similar conditions. A. J. E. W.

Radioactivity induced in the rare-earth elements by fast neutrons. M. L. Pool and L. L. Quill (Physical Rev., 1938, [ii], **53**, 437—446).—All the rare-earth elements (except Il, Tm, and Lu) were bombarded with slow neutrons and with fast neutrons obtained from the Li + D reaction. The following periods for electron emission were observed: ^{140}La 31 hr., ^{142}Pr 19 hr., ^{147}Nd 84 hr., ^{149}Nd 2·0 hr., ^{151}Nd 21 min., ^{144}Il 12·5 hr., ^{151}Sm 21 min., ^{153}Sm 46 hr., ^{152}Eu 9·2 hr., ^{160}Tb 3·3 hr., ^{165}Dy 2·5 hr., ^{164}Ho 47 min., ^{166}Ho 30 hr., ^{169}Er 12 hr., ^{171}Er 5·1 hr., and the following for positron emission: ^{139}Ce 2·1 min., ^{140}Pr 3·5 min., ^{150}Eu 27 hr., ^{158}Tb 3·6 min., ^{159}Dy 2·2 min., ^{165}Er 1·1 min. There is evidence of two isomeric isotopes, ^{159}Gd 3·5 min. and 17 hr., and ^{175}Yb 2·1 hr. and 14 hr. Radioactivity data indicate four new stable isotopes: ^{152}Gd, ^{160}Dy, ^{164}Er, and ^{170}Yb. N. M. B.

Proton-induced radioactivities. L. A. Du Bridge, S. W. Barnes, J. H. Buck, and C. V. Strain (Physical Rev., 1938, [ii], **53**, 447—453).—Previous reports (cf. A., 1937, I, 438) are summarised and extended by tabulated results and discussion of the radioactivities produced by 4 m.e.v. protons in targets of N, O, Ca, Cr, Co, Zn, Se, Mo, Pd, Cd, and In, with a detailed study in the case of O, Zn, and Se. N. M. B.

Concentration of radiohalides and failure to observe γ-rays from ^{128}I. A. Roberts and J. W. Irvine, jun. (Physical Rev., 1938, [ii], **53**, 609).—There is evidence of $<0·1$ γ-ray of energy 0·5 m.e.v., per β-ray. A rapid and convenient modification of d'Agostino's method of concentrating radioactive I and Br is described. N. M. B.

Nuclear energy sources and stellar evolution. G. Gamow (Physical Rev., 1938, [ii], **53**, 595—604).—Mathematical. N. M. B.

Rate of selective thermonuclear reactions. G. Gamow and E. Teller (Physical Rev., 1938, [ii], **53**, 608—609; cf. preceding abstract).—Mathematical. N. M. B.

Statistical theory of nuclear collisions. L. Goldstein (J. Phys. Radium, 1938, [vii], **9**, 96—104).—Theoretical. W. R. A.

Electromagnetic properties of nuclear systems. W. E. Lamb, jun., and L. I. Schiff (Physical Rev., 1938, [ii], **53**, 651—661).—Mathematical. N. M. B.

Heavy β-rays? G. E. M. Jauncey (Physical Rev., 1938, [ii], **53**, 669).—A discussion of the nature and properties of scattered β-rays previously reported (cf. A., 1938, I, 168, 169). N. M. B.

Absorption of high-energy electrons. III. A. J. Ruhlig and H. R. Crane (Physical Rev., 1938, [ii], **53**, 618—621; cf. A., 1937, I, 594).—Losses in Pb of electrons with energies above and below the range 2—11 m.e.v. were measured. For the high-energy group (5—15 m.e.v.) the electrons and positrons produced by the Li + ^{1}H γ-radiation were used. The vals. found are about 50% > the calc. losses due to ionisation and radiation, but are in good accord with previous experimental vals. N. M. B.

Nature of the heavy electron. I. M. Freeman (Physical Rev., 1938, [ii], **53**, 606—607; cf. A., 1938, I, 115).—Mathematical. It is suggested that the "new" particle is 137 times as heavy as a normal electron. N. M. B.

The heavy electron. J. L. Destouches (Compt. rend., 1938, **206**, 1095—1097).—The mass of the heavy electron is given as about 230 times that of the normal electron. H. J. E.

Heavy electrons in cosmic rays. E. J. Williams and E. Pickup (Nature, 1938, **141**, 684—685; cf. A., 1937, I, 390).—Additional evidence for the existence of particles of mass between that of the electron and proton is given. Four curved tracks obtained in a Wilson chamber using magnetic fields of 1000 and 2200 gauss indicate that the mass of the new particle is nearly 200 times that of the electron. L. S. T.

Hard cosmic-ray showers. K. Schmeiser and W. Bothe (Ann. Physik, 1938, [v], **32**, 161—177; cf. A., 1938, I, 57). O. D. S.

Properties of the penetrating component of cosmic radiation. (Mme.) T. Grivet-Meyer (Compt. rend., 1938, **206**, 833—835).—Measurements of the total vertical intensity, the intensity of the hard component, and no. of cosmic showers, made under different conditions of screening, are described, and the variation of these factors is discussed. The results are in accord with the theory that the penetrating component consists of heavy particles of varying masses (A., 1938, 1, 224). A. J. E. W.

Penetrating component of cosmic radiation. H. J. Bhabha (Proc. Roy. Soc., 1938, **A, 164**, 257—294).—Analysis of the experimental data suggests that they are best explained by assuming the penetrating component to consist of particles with masses between those of the electron and the proton. The implications of this assumption are discussed. G. D. P.

Penetrating component of cosmic radiation. R. M. Langer (Physical Rev., 1938, [ii], **53**, 494—495; cf. Bowen, A., 1938, I, 171).—A review of available data supports the hypothesis that there are, in secondary cosmic radiation, electrons of the usual mass, of much greater mass, and of intermediate mass. The treatment of electronic mass as a quantised parameter is examined. N. M. B.

Remarkable ultra-ray shower. H. Maier-Leibnitz (Naturwiss., 1938, **26**, 217—218).—A photograph of a "hard" ultra-ray shower is given. A. J. M.

Latitude effect of the soft component of cosmic rays. B. GROSS (Physical Rev., 1938, [ii], **53**, 607).—Mathematical. The latitude effect of the high-altitude part of the absorption curve is evaluated. N. M. B.

Cosmic rays and the aurora of Jan. 25–26th, 1938. V. F. HESS, R. STEINMAURER, and A. DEMMELMAIR (Nature, 1938, **141**, 686—687). L. S. T.

Intensity of primary cosmic radiation and its energy distribution. T. H. JOHNSON (Physical Rev., 1938, [ii], **53**, 499—501; cf. A., 1938, I, 171).—The no. of primary cosmic rays incident on one horizontal sq. cm. at the top of the atm. is calc. There is evidence of a low energy limit at $4{\cdot}4 \times 10^9$ v. The no. of primary rays increases from 0·03 at the equator to 0·36 per sq. cm. per sec. at latitudes above 45°. The total cosmic-ray current to the earth is 8×10^{17} rays per sec., or 0·13 amp. N. M. B.

Investigation of the Bhabha–Heitler theory of shower formation by cosmic rays for the case of coal. A. VALKÓ (Helv. Phys. Acta, 1938, **11**, 59—86; cf. A., 1937, I, 440).—The variation with thickness of the no. of showers produced in coal has been investigated and the absorption of the secondary rays from coal and Pb measured. The max. no. of showers in coal is produced at about 80 cm. thickness, in agreement with the Bhabha–Heitler theory. For the thickness of max. intensity, the absorption coeff. of secondary rays from coal is < that of Pb secondaries and is const. The absorption coeff. of Pb secondaries decreases with increasing thickness of the absorption layer up to about 1·5 cm. Pb, when it becomes equal to that of the coal secondaries. This result agrees with the Bhabha–Heitler theory. O. D. S.

Cosmic-ray ionisation in the neighbourhood of a lead block. E. G. SCHNEIDER (Physical Rev., 1938, [ii], **53**, 615—617).—An analysis of 2500 stereoscopic photographs of electron tracks shows that about 75% of the ionisation is due to single particles, 20% to photon-produced pairs, and 5% to secondaries ejected by particles. N. M. B.

Atomic hydrogen. K. S. BAGDASARJAN (Uspech. Chim., 1936, **5**, 39—65).—A review. CH. ABS. (*e*)

Electricity and the nucleus of atoms. M. DE BROGLIE (Nuovo Cim., 1937, **14**, 439—444).—A survey of the constitution of at. nuclei. O. J. W.

Recent models of the structure of the atomic nucleus. C. F. VON WEIZSÄCKER (Naturwiss., 1938, **26**, 209—217, 225—230).—A review. A. J. M.

Quantum of action and the atomic nucleus. N. BOHR (Ann. Physik, 1938, [v], **32**, 5—19).—A survey of the quantum theory of heavy nuclei. O. D. S.

Self-consistent field for iron. M. F. MANNING and L. GOLDBERG (Physical Rev., 1938, [ii], **53**, 662—667).—The results of self-consistent field calculations for the d^6s^2 configuration of Fe are reported. A brief discussion of the relation of the results to spectroscopy and to Slater's theory of ferromagnetism is given. N. M. B.

Self-consistent field with exchange for calcium. D. R. HARTREE and W. HARTREE (Proc. Roy. Soc., 1938, **A**, **164**, 167—191).—The results of calculations for Ca^{++} are tabulated. Fock's equation is solved for the $(4s)$, $(4p)$, and $(3d)$ states of Ca^+ and the $(4s)^2$, $(4s)(4p)^3P$, and ^1P states of neutral Ca. Energy vals. of these are compared with those observed. Transition probabilities of lines of astrophysical interest are calc. G. D. P.

Screening numbers and transitions between the multiplets of the ground term of the rare-earth ions. H. GOBRECHT (Ann. Physik, 1938, [v], **31**, 755—760).—Theoretical. The multiplet structures, as determined from fluorescence and infra-red absorption measurements, are given for the ground terms of the rare-earth ions from Ce^{+++} to Yb^{+++}, and screening nos. are deduced. O. D. S.

Structure of heavy elementary particles. G. BECK (Nature, 1938, **141**, 609).—Theoretical. L. S. T.

Penetrability of a simple type of potential barrier. F. C. HOYT (Physical Rev., 1938, [ii], **53**, 673).—Mathematical. For possible use in nuclear radii calculations, the transmission coeff. is expressed exactly in terms of known functions and applies to a potential barrier which is the negative of the Kratzer potential joined to a square well near the origin. N. M. B.

Heating of crystals by the Kossel effect. M. VON LAUE (Physikal. Z., 1938, **39**, 339—343).—Mathematical. The stationary temp. distribution in a cylindrical anticathode, taking into account the depth of penetration of electrons, is calc. A. J. M.

Chemical composition and internal structure of stars. H. HAFFNER (Naturwiss., 1938, **26**, 164—168).—A review of papers given at a conference at Göttingen in Jan., 1938, dealing with the Vogt–Russell law, and deviations from it, the abundance of elements in stars, and solar radiation in the Lyman region. A. J. M.

Geometrical structure of space and electronic atmospheres. G. FOURNIER (Compt. rend., 1938, **206**, 1097—1099). H. J. E.

Form of the solutions of the Dirac equations, and of the equations of the photon. G. PETIAU (Compt. rend., 1938, **206**, 991—993).—Mathematical. A. J. E. W.

Artificial boundary conditions in the Kepler problem. A. SOMMERFELD and H. WELKER (Ann. Physik, 1938, [v], **32**, 56—65).—Mathematical. The Kepler problem is solved for the case in which a boundary is imposed, as by a steep potential barrier, and the ground states of the confined H atom are determined. O. D. S.

Critical velocity principle in the materialisation of the photon. S. A. DE MAYOLO (Compt. rend., 1938, **206**, 988—990; cf. A., 1937, I, 492).—Theoretical. A. J. E. W.

Change and exchange of rest mass of elementary particles during collisions. F. ZWICKY (Physical Rev., 1938, [ii], **53**, 611; cf. A., 1938, I, 172).—Mathematical. N. M. B.

***X* particle.** A. BRAMLEY (Science, 1938, **87**, 281—282).—A summary of the properties of the new

particle, which has the same charge as an electron but a spin $>\frac{1}{2}$, to be expected on the basis of the Dirac theory. L. S. T.

Rate of an atomic clock in motion. H. E. IVES (Nature, 1938, **141**, 551).—Using an improved canal-ray tube of the Dempster type and a diffraction grating of 15,000 lines to the inch, a displacement of H lines of approx. 0·05 A. towards the red, which is independent of the orientation of the apparatus, has been observed. This positive effect confirms the Larmor–Lorentz theory of the relation between matter and the luminiferous æther. L. S. T.

Collision between a high-energy neutron and a proton, treated by the Born approximation method. T. KAHAN (Compt. rend., 1938, **206**, 742—744).—Mathematical. A. J. E. W.

Transmutation function for deuterons. P. L. KAPUR (Proc. Roy. Soc., 1937, **A**, **163**, 553—568).—The results of a theoretical investigation are compared with experiments on Cu. Fair agreement is obtained when the binding energy of the deuteron is taken to be 2·25 mv. G. D. P.

Magnetism and the vibratory electron. E. T. JONES (Phil. Mag., 1938, [vii], **25**, 682—693).—Theoretical. H. J. E.

Magnetic moments of $^{8}_{3}$Li, $^{9}_{3}$Li, and $^{19}_{9}$F. I. I. RABI, S. MILLMAN, P. KUSCH, and J. R. ZACHARIAS (Physical Rev., 1938, [ii], **53**, 495).—The vals. measured by the mol. beam method (cf. A., 1938, I, 172) are 0·823±0·005, 3·265±0·016, and 2·635±0·014 nuclear magnetons, respectively. Results are compared with available data of other investigators. N. M. B.

Nuclear magnetic moments. D. R. INGLIS (Physical Rev., 1938, [ii], **53**, 470—474).—The separability of the orbital and spin moments of protons and neutrons is discussed. N. M. B.

Fine structure of the nuclear ground level of ^{7}Li. G. BREIT and J. R. STEHN (Physical Rev., 1938, [ii], **53**, 459—469).—Calculations are made of the fine structure of the ground level of the ^{7}Li nucleus to throw light on the form of the interaction energy between pairs of nuclear particles and show how, with approx. assumptions about the wave function, adjustable parameters should be chosen to agree with observed fine structure. A general rule simplifying the calculation of the spin–orbit interaction with a closed shell is developed for interactions between pairs of particles. An examination of considerations affecting the choice of parameters emphasises that at present the calculations are only qual. N. M. B.

Positive column of a mercury arc. (A) Emission of radiation. (B) Mechanism in mercury vapour at intermediate pressures. B. T. BARNES and E. Q. ADAMS (Physical Rev., 1938, [ii], **53**, 545—556, 556—563; cf. A., 1935, 272).—(A) Intensities, corr. for absorption, of the principal lines of λλ 2259—11,289 arc given for 4-amp. Hg arcs operated at 0·03, 20, 450, and 500 mm. v.p. Intensity data are plotted on the basis of two alternative theories of arc mechanism and the results discussed.

(B) Calculations based on the radiant intensity for the principal spectral lines of 4-amp. Hg arcs at 450 and 500 mm. pressure indicate, for low quantum states, a dynamic equilibrium with electrons at approx. 6000° K., the temp. indicated by the abs. intensity for three reversed lines. For higher quantum states, differing only in total quantum no., there appears to be a tendency towards Boltzmann equilibrium due to collisions with normal atoms at ~2500° K., the temp. calc. from the heat balance by Langmuir's theory of conduction and convection in gases. This agrees with predictions from the principle of spectroscopic stability. N. M. B.

Multiple states in the high-pressure discharge. C. G. SUITS (Physical Rev., 1938, [ii], **53**, 609).—Data are reported for a normal arc state I and glow states II and III in H_2 at 1 atm. pressure and pure C electrodes. The transitions I → II and II → III are accompanied by changes in total voltage of 96 and 130 v., respectively. Photographs show that I is a highly luminous column, II is a less intense striated discharge with a well-developed cathode dark space, and III has the same column as II but the dark space is replaced by an intense glow from which streamers emanate. Evidence of additional states with W and with Cu electrodes was found. N. M. B.

Oxidation in arc cathodes. C. G. SUITS and J. P. HOCKER (Physical Rev., 1938, [ii], **53**, 670; cf. preceding abstract).—Evidence is reviewed which shows that with "cleaned" electrodes in O_2-free gases, the arc form cannot occur in low current ranges, a striated glow being obtained. With greater currents an incipient discharge tends to take a long path to uncleaned parts of the electrode or to the oxidised magnetic pole pieces. Arc stability and interpretations are discussed. N. M. B.

Spectrum of tervalent thulium. H. GOBRECHT (Ann. Physik, 1938, [v], **31**, 600—608).—The absorption spectrum of $Tm_2(SO_4)_3,8H_2O$ and the emission spectrum of Tm phosphors have been measured and analysed. Frequencies of the centres of the groups are tabulated. O. D. S.

Fluorescence and absorption spectra of Pr^{+++} and Eu^{+++}. I. Energy states of Pr^{+++}. H. LANGE (Ann. Physik, 1938, [v], **31**, 609—619).—The method of Slater (A., 1930, 126) is applied to the analysis of the spectra of Pr^{+++}. The analysis of Gobrecht (A., 1938, I, 119) is confirmed and extended. O. D. S.

Spectra of the monoxides of cerium and praseodymium. W. W. WATSON (Physical Rev., 1938, [ii], **53**, 639—642).—Vibrational quantum assignments are given for five sparsely developed emission band systems of CeO and one of PrO, and comparison is made with two GdO systems and one LuO system. Reasons for incomplete or absent rare-earth oxide band systems are discussed. Fairly intense systems seem to exist only for those rare earths having a *d* electron in their normal configuration. N. M. B.

Band system of antimony nitride. (MISS) N. H. COY and H. SPONER (Physical Rev., 1938, [ii],

53, 495).—A new band system extending from 2890 A. to longer λλ and degraded towards the red has been photographed in a discharge through a mixture of N_2 and Sb vapour. The system shows the same intensity distribution as the band spectra of PN and AsN. N. M. B.

Band spectrum of indium hydride. B. GRUNDSTRÖM (Nature, 1938, **141**, 555).—Details of the spectrum of InH, obtained in the region 5600—8500 A. from an arc between electrodes of In and C in H_2 at high pressure, are given. Some bands also appear in the red and infra-red. Rotational consts. are recorded. L. S. T.

Ultra-violet emission spectrum of the slow thermal dissociation of sodium azide. R. AUDUBERT (Compt. rend., 1938, **206**, 748—750).—The emission spectrum of NaN_3 undergoing decomp. at >365° has been investigated between 1890 and 2800 A., using a quartz prism monochromator and a CuI photon counter. The observed bands coincide with those for AgN_3 (A., 1937, I, 493), although the energy of activation for the decomp. of NaN_3 above 365° (23—25 kg.-cal.) is ≪ that for AgN_3 at the temp. used (46—48 kg.-cal.). The bands, which are probably due to transitions in the N_2 mol., are likely to occur with all azides. A. J. E. W.

Absorption spectra of some metallic salts at higher temperatures. Y. SHIBATA and T. NAKAI (J. Chem. Soc. Japan, 1936, **57**, 166—172).—The absorption spectra of 0·05M-$CO(NH_2)_2$ solutions of $CrCl_3,6H_2O$, $[Cr\{CO(NH_2)_2\}_6]Cl_3$, $CoCl_2,6H_2O$, $NiCl_2,6H_2O$, $CuCl_2,2H_2O$, $CuSO_4,5H_2O$, and $UO_2(NO_3)_2,6H_2O$ were studied at 145—150°. The two Cr salts have approx. the same absorption. The Ni salt gave the same absorption as its EtOH solution at a lower temp. The U salt showed 11 absorption bands. CH. ABS. (c)

Optical and photochemical study of cuprous halide vapours. J. TERRIEN (Ann. Physique, 1938, [xi], **9**, 477—538).—The polymerised vapours of Cu_2Cl_2, Cu_2Br_2, and Cu_2I_2 have similar properties; they show continuous absorption of short λλ in the ultra-violet, and the absorption extends to longer λλ with rise of temp. and pressure. In the case of Cu_2Cl_2 it reaches a max. around 2230 A., and a study of the fluorescence shows that the radiation absorbed in this region induces dissociation into two CuCl ions, one of which is excited and emits bands in fluorescence characteristic of CuCl. The fluorescence spectrum includes the Cu doublet λλ 3247—3274 due to the expulsion, in a second mode of dissociation, of Cu from the Cu_2X_2 mol. followed by an optical resonance characteristic of these momentarily liberated atoms. The velocity of these atoms at the moment of photodissociation, and the ultra-violet λ limit of each mode of dissociation, have been determined. The dissociation energy of each mode agrees with the val. calc. thermochemically. The band spectrum of CuCl, for which only the vibrational structure was known, has been obtained with strong intensity by a discharge in Cu_2Cl_2 vapour, and photographed with high dispersion. The rotational structure has been investigated and the bands of four isotopic CuCl mols. have been separated and identified. N. M. B.

Polarisation of the absorption lines of single crystals of rare-earth salts. K. S. KRISHNAN and D. C. CHAKRABARTY (J. Chem. Physics, 1938, **6**, 224—225).—From a study of the absorption spectra of rare-earth salts of the type $M_2(SO_4)_3,8H_2O$ Spedding concluded that the rare-earth ions should have cubic symmetry. Many of these crystals are magnetically anisotropic, indicating deviation from cubic symmetry. The absorption spectra of $Pr_2(SO_4)_3,8H_2O$ and $Nd_2(SO_4)_3,8H_2O$ in polarised light have been examined and the results indicate deviation from cubic symmetry. W. R. A.

Visible radiation of pure liquids under the action of fast electrons. P. A. TSCHERENKOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Phys., 455—492; cf. A., 1937, I, 220, 546).—Fast electrons passing through pure liquids cause a weak visible radiation with anomalous polarisation. The spectrum of the radiation is continuous and extends into the far ultra-violet. The energy distribution of the spectrum increases with decreasing λ. The radiation is asymmetric and is propagated in the direction of the beam of electrons, but the max. radiation is at a definite angle with the direction of the electrons related to the *n* of the liquid. The results are in agreement with the theory of Frank *et al.* (A., 1937, I, 220). A. J. M.

Wave-length of radiation emitted by electrified dielectrics; its theoretical interpretation. F. PERRIER (Compt. rend., 1938, **206**, 831—833; cf. A., 1937, I, 346; 1938, I, 119).—The absorption coeff. of celluloid for the radiation emitted by electrified amber, ebonite, and S has been measured; the results indicate that the radiation has a λ of the order of 10 A. It is postulated that the frequency of the emitted radiation is ∝ the p.d. between the faces of the dielectric. A. J. E. W.

Electron spectra of polyatomic molecules. I. The Franck–Condon principle. F. DUSCHINSKI (J. Phys. Chem. Russ., 1938, **11**, 112—123).—Theoretical. J. J. B.

Effect of position of substituents on the ultra-violet absorption of the benzene chromophore. III. M. PESTEMER and H. FLASCHKA (Monatsh., 1938, **71**, 325—332; cf. A., 1937, I, 494).—The behaviour of the C_6H_6 nucleus as a chromophore when conjugated with an atom (I) or an ion (O^- or SO_3^-) has been investigated. The absorption curves in the ultra-violet of the following substances were determined: *o*-, *m*-, and *p*-$C_6H_4I{\cdot}NH_2$, PhOH, *o*-, *m*-, and *p*-$NH_2{\cdot}C_6H_4{\cdot}OH$, $PhSO_3Na$, and *o*-, *m*-, and *p*-$NH_2{\cdot}C_6H_4{\cdot}SO_3H$, in N-NaOH, N-$H_2SO_4$, and H_2O. Two bands occur in the absorption spectra, one of lower λ (*A*) and one of higher λ (*B*). Both bands of the unsubstituted parent substances (PhI, $PhSO_3Na$, PhOH) are displaced to lower frequencies on introduction of NH_2. The band *B* is affected most strongly when the substitution is *p*, and least when it is *o*. The addition of excess of acid to the solvent causes the effect of the introduced NH_2 to disappear. A. J. M.

Secular equation for molecular vibrations. E. B. WILSON, jun., and B. L. CRAWFORD, jun. (J. Chem. Physics, 1938, **6**, 223).—A modification of the procedure adopted by Redlich and Tompa (A., 1937, I, 445) for eliminating the six zero roots of the secular equation for the vibration frequencies of an N-at. mol. is discussed. Other methods are reviewed and disadvantages of the several methods are discussed. W. R. A.

Continuous absorption spectrum of methyl bromide and its quantal interpretation. P. FINK and C. F. GOODEVE (Proc. Roy. Soc., 1937, **A**, **163**, 592—605).—The extinction coeff. is measured photographically in the range of frequencies 34,000 to 53,000 cm.$^{-1}$ A theoretical treatment, previously applied to the bands of diat. mols., is extended to interpret the band of MeBr. The extinction coeff. curve is resolved into the parts arising from mols. in various vibrational states. G. D. P.

Inner rotation and normal vibrations of ethane. I. Infra-red spectrum and the normal vibrations of ethane. E. BARTHOLOMÉ and J. KARWEIL. **II. Inner heat of rotation of ethane between 94° and 150° K.** W. HUNSMANN (Z. physikal. Chem., 1938, **B**, **39**, 1—22, 23—43; cf. A., 1937, I, 495).—I. The infra-red absorption spectrum of C_2H_6 has been examined over the frequency range 2000—3300 cm.$^{-1}$ and is accounted for on the basis of the point-group D_{3h}. New vibrational bands are recorded, involving an important new frequency at 740 cm.$^{-1}$ The view that fortuitous resonance occurs between two vibrational states, accounting for hindrance of inner rotation (*ibid.*, 112), is probably incorrect.

II. A method for determining the thermal conductivity of gases at pressure $\lesssim 10^{-3}$ mm. is described. Data for C_2H_6 at $\lesssim 95°$ K. are not in accord with lit. or theoretical vals. At $<140°$ K. a sharp decrease of internal heat of rotation is observed, the val. reaching 0·4 g.-cal. per g.-mol. at 95° K. Possible explanations of these results are discussed. The entropy of C_2H_6 at 25°, deduced from these results, is compared with the val. calc. from other data. J. W. S.

Near infra-red absorption spectrum of sucrose crystals in polarised light. J. W. ELLIS and (MISS) J. BATH (J. Chem. Physics, 1938, **6**, 221—222).—The absorption spectrum of sucrose crystals in polarised light has been investigated between 0·8 and 2·5 μ. Bands associated with CH groups and with free and perturbed OH groups have been identified. The spectroscopic evidence supports the X-ray results and the potentialities of the method in the elucidation of the structure of org. mols., as an adjunct to X-rays, are outlined. W. R. A.

Infra-red absorption spectrum of nickel carbonyl vapour. C. R. BAILEY and R. R. GORDON (J. Chem. Physics, 1938, **6**, 225).—$Ni(CO)_4$ vapour has been examined from 1 to 20 μ. The results favour the tetrahedral model rather than the plane square model. The force consts. of the Ni–C and C–O bonds are 2·35 and 17·35 × 10^5 dynes/cm. approx. W. R. A.

Rotational transitions associated with radiation in water molecules in non-polar solvents. J. W. ELLIS and E. L. KINSEY (Physical Rev., 1938, [ii], **53**, 672; cf. A., 1937, I, 443).—A preliminary report is made of the extension of previous investigations on absorption bands of H_2O in CS_2 in the region 1—2 μ. to H_2O in CCl_4. Similar bands are found (cf. A., 1938, I, 174). N. M. B.

Application of infra-red absorption spectra to the determination of the position of the ethylenic linking in an aliphatic carbon chain. P. LAMBERT and J. LECOMTE (Compt. rend., 1938, **206**, 1007—1009; cf. A., 1937, I, 112, 394).—Unsaturated aliphatic hydrocarbons with branched chains give two strong absorption bands at ~ 850 and 890 cm.$^{-1}$; with unbranched chains these bands are displaced to 910—920 and 980—990 cm.$^{-1}$ if the C:C linking is at the end of the chain, or to 910—920 and 950—960 cm.$^{-1}$ in other cases, whilst the length of the chain only slightly affects the position of the bands. The position of a C:C linking which does not terminate a chain may be deduced from absorption bands in the range 720—780 cm.$^{-1}$; thus Δ^{β}-heptene gives bands at 725 and 770 cm.$^{-1}$, which are absent with Δ^{γ}-heptene. The above results are also confirmed for a no. of compounds containing Br, CN, and OH. The observed bands are due to the C chain vibrating as a whole; the existence of two bands in each case may indicate the occurrence of two forms of mol. A. J. E. W.

Raman and infra-red spectra of chlorobromomethanes. H. VOLKRINGER, J. LECOMTE, and A. TCHAKIRIAN (J. Phys. Radium, 1938, [vii], **9**, 105—108).—The Raman and infra-red spectra of CCl_3Br, CCl_2Br_2, and $CClBr_3$ have been studied. The spectroscopic results agree with a tetrahedral structure for these mols. W. R. A.

Modification of the phosphorescence of a zinc sulphide semi-conductor under the influence of an electric current. G. DÉCHÈNE (J. Phys. Radium, 1938, [vii], **9**, 109—119).—An extension of earlier work (cf. A., 1938, I, 12). W. R. A.

Phosphorescence and phosphors. A. J. MEE (Sci. Progr., 1936, **30**, 635—643).—A review. CH. ABS. (*e*)

Effect of temperature on the Raman spectrum of liquid carbon tetrachloride. Preliminary considerations. R. ANANTHAKRISHNAN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 196—207).—The Raman spectrum of liquid CCl_4 has been examined between 25° and 200°. The degenerate vibrations at 218, 314, 762, and 790 cm.$^{-1}$ and, to a smaller extent, the symmetrical vibration at 459 cm.$^{-1}$, show considerable broadening at higher temp. The symmetrical vibration also shows a small diminution in frequency (2—3 wave nos.) at higher temp. Contrary to Placzek's theory, rise of temp. does not cause any appreciable increase in the intensity of the Stokes lines, and it is suggested that the effect of anharmonicity of the nuclear vibrations and the centrifugal stretching of the mol. due to rotation are responsible. C. R. H.

Raman effect in sodium nitrate. P. PATTABHIRAMAYYA (Proc. Indian Acad. Sci., 1938, **7**, **A**, 229—234).—Using a large crystal of $NaNO_3$, it has been shown that raising the temp. to 280° reduces

the frequency of the main 1069 cm.$^{-1}$ line by 3—4 wave nos. Of the two lattice oscillations at 185 and 95 cm.$^{-1}$, the former is more intense at room temp., the latter at 280°. The differences suggest a release of the crystal lattice forces at high temp. without any setting in of a free rotation of NO_3'. With solutions of $NaNO_3$, the principal frequency at 1069 cm.$^{-1}$ due to NO_3' decreases with dilution, and the 730 cm.$^{-1}$ line gains in intensity when compared with the 1400 cm.$^{-1}$ line. In solutions the pattern due to NO_3' resembles that due to CO_3'' in the solid state.

C. R. H.

Effect of oblique refraction at the prism surfaces on the relative intensities of Raman lines. A. V. Rao (Proc. Indian Acad. Sci., 1938, **7**, **A**, 208—213).—The effect on the intensity of Raman lines of the alteration of the state of polarisation of the incident beam due to passage through the instrument, and of the direction of illumination, is discussed. Well polarised lines suffer a greater intensity loss than unpolarised lines after passing through the instrument. Side illumination diminishes and top illumination increases the intensity of well polarised lines in relation to unpolarised lines.

C. R. H.

Raman effect. LXXXII. Nitrogen compounds. 10. (α-Amino- and α-hydroxy-propionic acid and their esters.) O. Burkhard and L. Kahovec (Monatsh., 1938, **71**, 333—345).—The Raman spectra of $NH_2{\cdot}CHMe{\cdot}CO_2H$ and its Me, Et, Pr^{β}, and Bu esters, $NMe_2{\cdot}CHMe{\cdot}CO_2H$ and its Me and Et esters, $OH{\cdot}CHMe{\cdot}CO_2H$ and its Me, Et, Pr^{β}, and Bu esters, $OMe{\cdot}CHMe{\cdot}CO_2H$ and its Me and Et esters, $CHClMe{\cdot}CO_2H$, $CHBrMe{\cdot}CO_2H$, and their Me, Et, Pr^{β}, and Bu esters are recorded. The NH- and CO-frequencies are calc. The replacement of Me by OH or NH_2 produces no alteration in the spectral type, from which it is concluded that the NH_2 group in the acids and esters behaves as in the aliphatic amines.

A. J. M.

Low and high Raman frequencies of water. G. Bolla (J. Chem. Physics, 1938, **6**, 225—226).—Microphotometric tracings of the Raman spectrum of H_2O are reproduced in support of arguments to prove that lines reported at 172, 510, 780, 2150, and 3990 cm.$^{-1}$ have real existence, in spite of the doubt cast on this by Rao and Koteswaram (A., 1937, I, 496).

W. R. A.

Fine structure of the totally symmetrical Raman lines in benzene and hexadeuterobenzene. A. Langseth and R. C. Lord, jun. (J. Chem. Physics, 1938, **6**, 203—204).—The origin of the four satellites of the 992 cm.$^{-1}$ Raman line of C_6H_6 is discussed; two are totally symmetrical frequencies of $^{12}C_5{}^{13}CH_6$; the other two are due to transitions from the first excited state of the E_g^+ vibration (ν_6) to the two levels of the resonance doublet E_g^+ (ν_8). On the basis of this interpretation, quant. predictions of the frequencies and intensities of the satellites agree satisfactorily with experimental data. In C_6D_6 the 945 cm.$^{-1}$ Raman line has fewer satellites, since in this case ν_8 is a single frequency.

W. R. A.

Raman spectrum and constitution of pentaerythritol. P. G. N. Nayar (Proc. Indian Acad. Sci., 1938, **7**, **A**, 251—256).—The 21 frequencies observed in the Raman spectrum are < half the total no. of possible normal modes of vibration, viz., 57. This suggests tetrahedral structure, since with pyramidal structure >28 vibrations would be expected. Tetrahedral structure is indicated for both the inner C core (neopentyl group) and the mol. as a whole, in agreement with *X*-ray evidence. From the frequency of the O–H band in pentaerythritol, viz., 3252 and 3335 cm.$^{-1}$, it is considered that the mols. are linked by H bonds.

C. R. H.

Raman spectra of some molybdates in aqueous solution. (Mlle.) M. Theodoresco (Compt. rend., 1938, **206**, 753—754; cf. A., 1932, 445).—$Na_2MoO_4{,}2H_2O$ gives the νν 313, 839, and 897 cm.$^{-1}$, due to MoO_4''. $(NH_4)_6Mo_7O_{24}{,}4H_2O$ and $Na_6Mo_7O_{24}{,}21H_2O$ give 938, 892, 431, 349, 293, and 211 cm.$^{-1}$, probably due to Mo_7O_{24}''; these compounds thus do not behave as double salts in solution.

A. J. E. W.

Dissociation of ethane by electron impact. J. A. Hipple, jun. (Physical Rev., 1938, [ii], **53**, 530—533).—The dissociation of C_2H_6, investigated with a new mass-spectrometer, shows one negative, two doubly-charged, and 14 positive ions corresponding with the various states of dissociation of the mol. An analysis of processes taking place in the upper mass-range is given.

N. M. B.

Simple critical potentials of carbon monoxide. J. Savard and M. de Hemptinne (Compt. rend., 1938, **206**, 998—1000; cf. A., 1937, I, 170, 279).—The possibility of interpreting the observed crit. potentials as min. activation energies of different electronic states of the mol., and the applicability of the Franck–Condon principle, are discussed.

A. J. E. W.

High-voltage polarisation in sodium nitrate. B. M. Hochberg (Physikal. Z. Sovietunion, 1937, **12**, 644—657).—The mechanism of low-voltage chemical polarisation, based on a conception of equilibrium between electrical and diffusion forecs, cannot be extended to high-voltage polarisation. The latter can be accounted for by postulating that the impurities in the body of the dielectric set up an internal field which prevents the escape of ions.

J. A. D.

Capacity at the contact of a metal and a semiconductor. G. Déchène (Compt. rend., 1938, **206**, 828—830).—Such contacts have the electrical characteristics of a resistance (*r*) shunted by a condenser, the effective capacity (*c*) of which increases with the conductivity of the semi-conductor. Vals. of *r* and *c* for a Hg–yellow HgO interface are recorded, and the Cu–Cu_2O interface is discussed.

A. J. E. W.

Permanent volume polarisation in certain types of multi-layers. R. W. Goranson and W. A. Zisman (Physical Rev., 1938, [ii], **53**, 668).—One of the two types of Langmuir–Blodgett multilayers is electrically neutral by internal compensation; the other should have a permanent vol. polarisation, and this was demonstrated by the deflexion in the field between parallel charged plates of a suspended ebonite cylinder on which had been deposited a

hemicylindrical coating of 340 layers of Ca stearate. The effect of field variation and of dipping the cylinder in H_2O, Hg, or dil. acid is described. The observed deflexion corresponds with a moment per mol. perpendicular to the surface of $0{\cdot}1 \times 10^{-18}$ compared with a calc. val. $0{\cdot}27 \times 10^{-19}$. N. M. B.

Dielectric polarisation of liquids in asymmetric fields. F. H. MÜLLER (Wiss. Veröff. Siemens-Werken, 1938, **17**, 20—37).—The effects of inhomogeneity of field on the dielectric const. (ϵ) of liquids are discussed. A non-homogeneous field should cause orientation of quadrupole mols. and translation of dipole mols. yielding a redistribution of concn. until equilibrium is attained with osmotic pressure effects. Actually changes in ϵ are small under ordinary conditions, but the use of a cylindrical condenser with a very thin wire as central electrode permits determination of quadrupolo moments. J. W. S.

Variation of the delay in discharge in oil in a non-uniform field with spark length. R. STRIGEL (Wiss. Veröff. Siemens-Werken, 1938, **17**, 38—47).—Data are recorded for discharges in oil between pointed electrodes 0·3—10 mm. apart, and between ball electrodes 5 cm. in diameter at similar distances, comparison being made with previous results (*ibid.*, 1937, **16**, 38) for a uniform field. J. W. S.

Physics of dielectric loss. P. O. SCHUPP (Wiss. Veröff. Siemens-Werken, 1938, **17**, 1—19).—The relationships between dielectric const., loss angle, and power loss are discussed for various arrangements of condensers with series and parallel resistances. The results are compared with deductions from the Wagner inhomogeneity theory and the Debye dipole theory, and an electrical representation of the dipolar mol. is deduced. The practical applications of these theories to various examples are discussed. J. W. S.

Theory of rotation transitions. G. HETTNER (Ann. Physik, 1938, [v], **32**, 141—147; cf. A., 1938, I, 121).—The variation of the dielectric const. of solid HCl in the neighbourhood of its transition point is discussed. O. D. S.

Dielectric constant of carbon disulphide at low temperature. R. GUILLIEN (Compt. rend., 1938, **206**, 1001—1002).—Vals. of ϵ and of the mol. polarisation in the temp. range $-115°$ to $20°$ are recorded; the ϵ–0 curve is linear down to the m.p., below which a rapid increase of ϵ occurs. The anomaly at $-90°$ recorded by Mazur (A., 1932, 9) is observed only with inefficient stirring and consequent inhomogeneity of the CS_2. A. J. E. W.

Dielectric constant and dipole moment of aluminium bromide. V. A. PLOTNIKOV, I. SCHEKA, and S. JANKELEVITSCH (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **4**, 382—383).—The temp. variation of fused $AlBr_3$ is given by $\epsilon = 3{\cdot}375 - 0{\cdot}003(t - 100)$. In liquid Br or CS_2 ϵ increases uniformly with concn., whereas in C_6H_6 it increases rapidly at very low and at high concns., and slowly at intermediate concns. The dipole moment is zero for the substance when fused or dissolved in Br or CS_2, corresponding with symmetrical Al_2Br_6 mols. The val. in dil. C_6H_6 solution, 5·03 D., indicates the existence of $AlBr_3$ or solvated mols. F. L. U.

Spatial arrangement of the thianthren molecule. E. BERGMANN and A. WEIZMANN (Chem. and Ind., 1938, 364; cf. Keats, A., 1937, II, 466).—The dipole moment of 2 : 6-dichlorothianthren in C_6H_6 at 25° is 1·37 D., confirming the slight departure from the plane in thianthren ($\mu_{corr.} = 1{\cdot}47$ D.). I. McA.

Dipole moment and free rotation. A. RIEDINGER (Physikal. Z., 1938, **39**, 380—384).—The dipole moment of hydrocarbons depends on the amplitude of rotational vibrations about the C-C linking, which is a function of temp. and potential gradient. The depth of the potential trough is determined by the strength of the polar groups and their mutual separation. To investigate the effect of the latter on the magnitude of the moment the dipole moments of saturated hydrocarbons with various H atoms substituted by Ph have been determined in C_6H_6 solution. Even with a small separation of the substituents there is practically no mutual effect, so that the polar group can rotate freely, and the $\cdot CH_2\cdot$ chains can rotate. In addition there is an independent arrangement of substituents in the direction of an applied electric field, which is confirmed by the high moments of $\alpha\gamma\epsilon$-triphenylpentane, $\alpha\epsilon\iota$-triphenylnonane, and $\alpha\gamma\epsilon\eta$-tetraphenylheptane. A. J. M.

Dispersion and optical anisotropy of molecular oxygen in relation to its absorption spectrum. P. PATTABHIRAMAYYA (Proc. Indian Acad. Sci., 1938, **7**, A, 235—244).—Mathematical. A new dispersion formula for gaseous O_2 has been derived which is simultaneously able to explain the observed optical anisotropy of the O mol. and its dispersion. The formula also predicts an increase of optical anisotropy in the ultra-violet region. C. R. H.

Birefringence of liquids under the action of ultrasonic waves. R. LUCAS (Compt. rend., 1938, **206**, 827—828).—A train of ultrasonic waves in a liquid may cause rotation of the plane of polarisation of a perpendicular beam of polarised light, the magnitude of the rotation depending on the liquid and on the angle between the plane of polarisation and the sound waves. The theory of the effect is given. A. J. E. W.

Optical activity in ketones. Rotatory dispersion and circular dichroism of *m*-methyl*cyclo*hexanone and of pulegone in their ketonic absorption bands. T. M. LOWRY, D. M. SIMPSON, and C. B. ALLSOPP (Proc. Roy. Soc., 1937, **A**, **163**, 483—498).—Mol. extinction coeffs., circular dichroism, and rotatory dispersion in the ultra-violet are recorded. Analysis of the observations shows that the rotation due to the ketonic absorption band of methyl*cyclo*hexanone is $>$ that of the single asymmetric C atom, and is opposite in sign. A similar result is obtained for pulegone. The optical activity of the carbonyl group is attributed to the lone-pair electrons of the O atom, and the theory of " induced dissymmetry " is re-interpreted. G. D. P.

Structure and properties of molecules. I. (1) Structure and polar properties. (2) Application to inorganic and organic compounds. II. Structure and acid and basic properties of molecules. V. RASUMOVSKIJ (Bull. Soc. chim., 1938, [v], **5**, 233—242, 243—249, 249—256).—I. A general discussion.

II. The strengths of acids and bases are discussed in terms of electronic structure. E. S. H.

The building of molecules. R. ROBINSON (Proc. Durham Phil. Soc., 1938, **9**, 360—381).—A lecture.

Stereochemistry of boric acid-diol derivatives. P. H. HERMANS (Rec. trav. chim., 1938, **57**, 333—341; cf. A., 1925, 500).—The derivatives are of two types, $\begin{matrix}>C\cdot O\\>C\cdot O\end{matrix}>B\cdot OH$ (I) and $\left[\begin{matrix}>C\cdot O\\>C\cdot O\end{matrix}>B<\begin{matrix}OH\\OH\end{matrix}\right]H$ (II), B being 3- or 4- (strongly acid) -valent respectively. The greater interat. distances between the O atoms of (II) (2·42 A.) and between O and B (1·48 A.) compared with (I) (2·32; 1·35 A.) are discussed.

A. T. P.

Liquid state. R. W. GURNEY and N. F. MOTT (J. Chem. Physics, 1938, **6**, 222).—Theoretical.

W. R. A.

λ-Phenomenon of liquid helium and the Bose–Einstein degeneracy. F. LONDON (Nature, 1938, **141**, 643—644).—Fröhlich's proposed mechanism (A., 1937, I, 505) for the λ-phenomenon is criticised, and a different interpretation is put forward. L. S. T.

Extension of Carlsohn's law to the crystalline state. R. LAUTIÉ and M. OSWALD (Bull. Soc. chim., 1938, [v], **5**, 277—285).—Carlsohn's law (A., 1925, ii, 1044) has been generalised for cryst. parameters. The results permit calculation of unknown parameters.

E. S. H.

Numerical valency in polyatomic molecules. H. LESSHEIM and R. SAMUEL (Phil. Mag., 1938, [vii], **25**, 667—677).—A review and discussion of the relationship between electron configuration and valency. H. J. E.

Valencies of carbon. R. TRUCHET (Bull. Soc. chim., 1938, [v], **5**, 468—479; cf. A., 1938, I, 122).—The ethylenic linking is examined on the assumption that three of the C bonds lie in a plane inclined at 120° to each other, but that the fourth electron is mobile and may associate with one or more other electrons of similar nature, the stability of this linking depending on the general mol. structure. Known properties (chemical reactivity, isomerism, with brief reference to magnetism, interat. distances, absorption spectra) of ethylene, allyl, and erythrene compounds, C_6H_6, Ph_2, CPh_3, anthracene, and phenanthrene are shown to be in accordance with the scheme. M. R.

Relationship between the density distribution of certain valency electrons (*B*-electrons) and reactivity in aromatic hydrocarbons. O. SCHMIDT (Z. physikal. Chem., 1938, **B**, **39**, 59—82; cf. A., 1937, I, 286; 1938, I, 14).—The non-reactivity of aromatic hydrocarbons, in spite of their unsaturated character, is explained by the localisation of the *B*-electrons in the inside of the aromatic ring, causing them to be shielded from external attack. The theory is discussed with reference to the internuclear distances in aromatic and other cyclic compounds.

J. W. S.

Improved Wigner–Seitz method for the calculation of electronic energy bands. G. WANNIER (Physical Rev., 1938, [ii], **53**, 671).—Limitations of the method as reported by Shockley (cf. A., 1938, I, 14) are overcome. N. M. B.

Electronic structure of some polyenes and aromatic molecules. IV. Nature of the links of certain free radicals. C. A. COULSON. **V. Comparison of molecular orbital and valency bond methods.** G. W. WHELAND. **VI. Phenylethylene, stilbene, tolane, and the phenylmethyl radical.** W. G. PENNEY and G. J. KYNCH (Proc. Roy. Soc., 1938, **A**, **164**, 383—396, 397—408, 409—420).—IV. Formulæ are given for the lengths of the links of free radicals and mols. of chain-form $C_{2n+1}H_{2n+3}$. The effect of resonance is to remove some of the characteristic properties of alternate single and double bonds. Numerical vals. are given for the cases $n = 2$, 3, and 4. The mean length of the links is approx. const., but the end link is always about 0·04 A. shorter than the others.

V. The two methods give concordant results when applied to polyenes and other mols., but in the case of *cyclo*butadiene, C_4H_4, discrepancies occur. These discrepancies are examined and the differences between C_4H_4 and C_6H_6 are discussed.

VI. Two methods (electron pairs and mol. orbitals) are used to calculate the internuclear distances in mols. containing the system C:CPh. The double linking is the same length as in C_2H_4; the ring distances are equal to those in C_6H_6, but the single linking has the short length 1·44 A. In the system C:CPh the triple linking is of normal length, 1·20 A.; the ring distances are as in C_6H_6, but the single linking has a length 1·41 A. These results are in agreement with the experimental vals. found by Robertson and Woodward (see below). G. D. P.

***X*-Ray analysis of the dibenzyl series. V. Tolane and the triple bond.** J. M. ROBERTSON and I. WOODWARD (Proc. Roy. Soc., 1938, **A**, **164**, 436—446).—Crystal data: $C_{14}H_{10}$, m.p. 60°, ρ (calc.) 1·134; monoclinic prismatic, space-group $P2_1/a$. Four mols. per unit cell of dimensions a 12·75, b 5·73, c 15·67 A., β 115·2°. The dimensions are similar to those of stilbene. The C–C triple bond distance is 1·19 A., and for the single bond joining these atoms to the C_6H_6 ring the unusually small distance 1·40 A. is found (cf. preceding abstract). G. D. P.

Anomalous vibrational spectra. M. BLACKMAN (Proc. Roy. Soc., 1938, **A**, **164**, 62—79).—An elastic continuum becomes unstable when the elastic consts. obey certain relations. The instability leads to a characteristic change in the vibrational spectrum of a lattice in which these relations hold. No actual crystals are near enough to the crit. regions for the effect to be apparent in the sp. heat, but in some cases it should be noticeable in the vibrational spectrum. G. D. P.

Calculation of the potential function and fundamental frequencies of the molecules

$C_2H_xD_y$ ($x+y=4$). Y. L. TCHANG (Ann. Soc. Sci. Bruxelles, 1938, **58**, [i], 87—97; cf. A., 1937, I, 67, 223, 398, 443).—Divergencies between observed νν and those calc. from the potential function of Manneback (*ibid.*, 67) increase with D content, and are due to neglect of anharmonicity. A correction for this (cf. A., 1935, 1057), giving for H and D the "spectroscopic" masses 1·088 and 2·126, is proved from νν of C_2H_4 and C_2D_4. Parameters and force consts. are redetermined. Calc. and observed νν for C_2H_3D, C_2HD_3, and *cis*-, *trans*-, and *as*-$C_2H_2D_2$ now agree to <1·4%. Predictions include the infra-red ν 693±2 cm.$^{-1}$ for C_2D_4. I. McA.

Rotational energy levels of a diatomic molecule in a tetrahedral field. H. M. CUNDY (Proc. Roy. Soc., 1938, **A**, **164**, 420—435).—The Schrödinger equation is solved by application of the theory of groups for the case of a diat. mol. when the potential energy has tetrahedral symmetry. Numerical vals. of the energy levels are obtained by use of the Mallock electric calculating machine and the results are shown graphically. G. D. P.

Forces acting between atoms and ions and the physical properties of matter in bulk. J. A. WASASTJERNA (Phil. Trans., 1938, **A**, **237**, 105—133).—Mathematical. A method is developed for the analysis, with the aid of available experimental data, of the dependence of the potential energy on the interat. distance for atoms and ions with closed shells. From the results, theoretical calculations are made of the compressibilities, elastic consts., proper frequencies of vibrations, amplitudes of the thermal vibrations, and energy of crystals, and comparisons are made with available experimental data. The structure of the lattice and the dependence of interat. distance on the no. of geometrically equiv. nearest neighbours is examined, and a theoretical interpretation of empirical results is given. N. M. B.

Theory of orientation separation of ionic crystals. I. N. STRANSKI and L. KRASTANOV (Monatsh., 1938, **71**, 351—364).—Theoretical. A. J. M.

Migration of energy in crystals and molecular complexes. F. MÖGLICH and M. SCHÖN (Naturwiss., 1938, **26**, 199).—That migration of energy in crystals and mol. complexes occurs is indicated by the phenomena of phosphorescence, C assimilation by plants, and radiative mutation of genes. Such an energy migration may occur through electron exchange. A. J. M.

Stability of polyatomic molecules in degenerate electronic states. II. Spin degeneracy. H. A. JAHN (Proc. Roy. Soc., 1938, **A**, **164**, 117—131; cf. A., 1937, I, 552).—A polyat. mol. cannot possess a stable non-linear configuration in an electronic state having spin degeneracy unless this degeneracy is the special twofold one which can occur only when the mol. contains an odd no. of electrons. The irreducible two-valued representations of all the point-groups are tabulated. G. D. P.

Continuum and swarm theories of the nematic phase. (A) H. ZOCHER. (B) R. FÜRTH and K. SITTE (Ann. Physik, 1938, [v], **31**, 570—578, 579—582).—A criticism of Fürth and Sitte (A., 1937, I, 553) and a reply. O. D. S.

Action of intermolecular forces in gases and liquids. E. STEURER and K. L. WOLF (Z. physikal. Chem., 1938, **B**, **39**, 101—125).—From measurements of gas pressure in unsaturated vapours of alcohols, ketones, and hydrocarbons, and of mol. wts. of alcohols in non-polar solvents a comparison of the effects of intermol. forces in gases and liquids is made. Apparatus for measuring gas pressures and v.p. is described. T. H. G.

Calculation of surface tension from measurements of sessile drops. A. W. PORTER (Phil. Mag., 1938, [vii], **25**, 752—754).—The problem of the calculation of surface tension from the height and radius of drops of all sizes has been solved. A better way of displaying results obtained by Bosanquet's method is discussed. T. H. G.

Determination of parachor in solution. II. Parachor of inorganic salts in aqueous solution. S. K. RAY (J. Indian Chem. Soc., 1938, **15**, 43—46; cf. A., 1934, 1295 and following abstract).—Parachors of NH_4Cl, NH_4Br, NH_4NO_3, KCl, and KI in aq. solution increase with increasing concn. but tend to const. vals. Distinction must be made between at. and ionic parachors. M. R.

Determination of the parachors of inorganic salts in solution and their structure. I. Potassium salts. J. V. LAKHANI and R. P. DAROGA (J. Indian Chem. Soc., 1938, **15**, 37—42).—Parachor vals. of various K salts in 0·01—0·06M aq. solution at 30° have been found by an extension of the equation applicable to mixtures of two liquids. Experimental vals. are in agreement with calc. $\Sigma[P]$. The at. parachor of K is taken as 110 for univalent salts and 106 for bivalent salts containing two K atoms. M. R.

Scattering of *X*-rays by liquid metal eutectics. V. J. DANILOV and J. V. RADTSCHENKO (Physikal. Z. Sovietunion, 1937, **12**, 756—760).—*X*-Ray photographs indicate that in the eutectic melts of Bi–Sn, Sn–Pb, Pb–Bi, and Sn–Zn the at. distribution is influenced by the same type of interat. forces as determine the structure of the solid phases. J. A. D.

Structure of liquid metals near recrystallisation. V. J. DANILOV and J. V. RADTSCHENKO (Physikal. Z. Sovietunion, 1937, **12**, 745—755).—Intensities of *X*-ray diffraction photographs of liquid Sn, Bi, and Pb are compared with the curves given by Prins and Petersen (cf. A., 1936, 553) for statistical regularity of interat. spacings in the liquid lattice. When the metal is just above the m.p., nuclei are formed in which the mols. have the same arrangement as in the solid crystal. J. A. D.

Photography of reciprocal lattice planes in a crystal with *X*-rays. W. F. DE JONG and J. BOUMAN (Physica, 1938, **5**, 220—224).—Previous theory (cf. A., 1938, I, 234) is extended and summarised, and disadvantages of the method are reviewed. A. J. E. W.

Scattering of *X*-rays by crystals of variable structure. I. M. LIFSCHITZ (Physikal. Z. Soviet-

union, 1937, **12**, 623—643).—Formulæ are derived for the intensity, direction, and half-width of the *X*-ray diffraction lines from lamellar variable-structure crystals which have domains of variable size and orientation, and variable lattice const. in each domain. Different types of aggregation are discussed and the results applied to crystals and alloys which show variable structure. J. A. D.

Crystal structure of insulin. I. Air-dried insulin crystals. D. CROWFOOT (Proc. Roy. Soc., 1938, **A, 164**, 580—602).—*X*-Ray investigation shows that insulin crystallises in the rhombohedral system, space-group *R*3, the unit cell having *a* 44·4 A. and α 114° 48′; referred to hexagonal axes $a = 74{\cdot}8$, $c = 30{\cdot}9$ A. The density of several samples varied from 1·292 to 1·316. The mol. wt. is calc. as 39,700 (±1000). When allowance is made for the H_2O content of the crystal the mol. wt. of the protein in the unit cell is 37,600. There is no crystallographic evidence that this wt. constitutes a single mol. Fourier synthesis shows the distribution of matter in the unit cell. It is suggested that the spacings 10 and 22 A. are related to the characteristic spacings of many proteins, both globular and fibrous. G. D. P.

Space-group of the stable modification of the crystals of *m*-nitrobenzoic acid. V. C. THAKAR (Current Sci., 1938, **6**, 446).—Examination by the rotation and oscillation method gives *a* 10·41, *b* 10·70, *c* 13·22 A., β 91° 12′; 4 mols. per unit cell; space-group C_{2h}^5. L. S. T.

Study of the crystals of *p*-nitroaniline and *p*-nitrotoluene by *X*-ray single-crystal rotation method. M. PRASAD and R. N. MERCHANT (J. Indian Chem. Soc., 1938, **15**, 47—52).—Unit cell dimensions found are: *p*-$NH_2{\cdot}C_6H_4{\cdot}NO_2$, *a* 15·31, *b* 6·085, *c* 8·36 A.; β 126° 11′; space-group C_{2h}^5. *p*-$C_6H_4Me{\cdot}NO_2$, *a* 6·41, *b* 14·10, *c* 15·39 A.; space-group Q_h^5. In each case one mol. forms an asymmetric unit of the cell. M. R.

Space-group determination of the crystals of *o*- and *p*-benztoluidides by the *X*-ray rotating-crystal method. M. PRASAD and A. B. KHAN (J. Indian Chem. Soc., 1938, **15**, 53—58).—Unit cell dimensions are respectively: *a* 26·116, 30·54, *b* 9·117, 8·24, *c* 9·87, 9·246 A.; space-group Q_h^{13}, Q_h^{11}. In each case one mol. forms an asymmetric unit of the cell. M. R.

***X*-Ray investigation of the structure of boron nitride.** A. C. BREGER (J. Phys. Chem. Russ., 1938, **11**, 28—32).—BN is hexagonal, *a* 2·51, *c* 6·69 A.; the unit cell contains 2 B with the co-ordinates ($\frac{1}{3}$, $\frac{2}{3}$, 0) and ($\frac{2}{3}$, $\frac{1}{3}$, $\frac{1}{2}$), and 2 N with the co-ordinates (0, 0, 0) and (0, 0, $\frac{1}{2}$). J. J. B.

Crystal structure of pentaerythritol tetra-acetate. T. H. GOODWIN (Proc. Roy. Soc., 1938, **A, 164**, 369—383).—The substance crystallises in the space-group $P4_2/n$; the tetragonal unit, having *a* 12·00 and *c* 5·506 A., contains two mols. The acetate group is planar. Interat. distances and valency angles are tabulated. G. D. P.

Space-group of cryolite, Na_3AlF_6. G. MENZER (Naturwiss., 1938, **26**, 236; cf. A., 1930, 140).—Further investigation shows that cryolite has the space-group C_{2h}^5, the cleavage direction being parallel to [101]. The arrangement of atoms in the elementary cell remains the same as before. A. J. M.

Polymorphism of alkaline-earth carbides. H. H. FRANCK (Compt. rend. XVII Cong. Chim. Ind., 1937, 1160—1165; cf. A., 1937, I, 320).—Further *X*-ray and thermal analysis of CaC_2 has revealed a face-centred cubic form CaC_2 IV, stable above 450°, having *a* 5·91 A. at 480°. Conditions for the occurrence, stability, and transformation of the 4 forms with respect to temp., grinding, and content of technical impurities ($CaCN_2$, CaS, Ca, etc.) are summarised. SrC_2 III and BaC_2 III cannot be obtained. I. McA.

***X*-Ray and optical properties of barium-copper stearate films.** C. HOLLEY (Physical Rev., 1938, [ii], **53**, 534—537; cf. A., 1936, 539).—Measurements of the *X*-ray spacing of films, built by successive deposition of layers 1 mol. thick and used as diffraction crystals to obtain *X*-ray spectra, give a const. val. of approx. 50·47 A. for films of the same composition of thickness 301—3000 layers, but varying with the % Cu in the film. The spacing is the same for mols. in adjacent layers oriented in the same or in opposite directions, and the unit decrement of *n* is $5{\cdot}1 \times 10^{-6}$. Measurements with a Michelson interferometer gave 24·23 A. for the spacing of mol. layers, and hence twice the layer spacing or 48·46 A. was expected (instead of 50·47 A.) for the grating spacing of films in which the mols. in adjacent layers were oriented in opposite directions. The discrepancy indicates that the *X*-ray spacing is not determined by the method of building the film. N. M. B.

***X*-Ray studies on liquids: inner peak for alcohols and acids.** W. C. PIERCE and D. P. MACMILLAN (J. Amer. Chem. Soc., 1938, **60**, 779—783).—Fourier analysis shows that the inner peak is due to an at. distribution not present in other liquids such as paraffins and esters. The distribution is explained on the basis of mol. clusters, due to association by H bridge formation, giving a plane rich in O atoms and lying at right angles to the hydrocarbon chains. The theory is applied to published data. E. S. H.

Rôle of foreign matter in the structure of crystalline liquids. P. GAUBERT (Compt. rend., 1938, **206**, 1030—1032; cf. A., 1938, I, 125).—The formation and occurrence of filaments due to impurities in anisotropic liquid drops of *p*-azoxyanisole or -phenetole on mica cleavage faces is discussed. These filaments give rise to optical anomalies, particularly for bands in which a strong pseudo-dichroism, due to the separation of particles of impurity near the filaments, is observed. A. J. E. W.

Focussing of an *X*-ray beam by a rock-salt crystal. R. M. BOZORTH and F. E. HAWORTH (Physical Rev., 1938, [ii], **53**, 538—544).—A single crystal was bent plastically and cut so that *X*-rays of a narrow range of λλ coming from the focal point of the *X*-ray tube are focussed at another point; the beam of about 6° divergence is thus monochromatised and conc. so that the intensities of the Fe *K*α lines

are about 30 times as great as when monochromatised by reflexion from a plane crystal. The point of focus was placed on the reflexion circle of a Sceman–Bohlin focussing camera and powder photographs were taken, with the advantage that the background is much diminished without serious loss of line intensity. N. M. B.

Résumé of electron diffraction. G. L. CLARK and E. WOLTHUIS (J. Chem. Educ., 1938, **15**, 64—75).—A review. L. S. T.

Properties of a bundle of monokinetic electrons after penetration of an absorbing foil. J. J. TRILLAT and A. HAUTOT (Ann. Physik, 1938, [v], **31**, 583—584).—A reply to Kirchner (A., 1938, I, 69). The discrepancy between the vals. of Trillat and Hautot (A., 1937, I, 541) and of Boochs (Kirchner, *loc. cit.*) for the energy loss of 45-kv. electrons on penetration of a 1 μ. Al foil is within the experimental error. O. D. S.

Further observations with the electron microscope. E. W. MÜLLER (Z. Physik, 1938, **108**, 668—680).—The structure of the single-crystal W tip of the cathode is studied by means of images formed when Ba vapour is projected laterally on to the tip. It is confirmed that the tip has a smooth spherical surface of approx. radius $0{\cdot}8 \times 10^{-5}$ cm. and under suitable conditions a magnification of 10^6 is obtained. Adsorption of single Ba ions may be observed during spread of the metal over the W surface. L. G. G.

Electron-optical observation of metal surfaces. III. Crystal growth and allotropic transition in zirconium. IV. Appearance of "lines" of high emissivity on nickel–iron crystals. W. G. BURGERS and J. J. A. PLOOS VAN AMSTEL (Physica, 1938, **5**, 305—312, 313—319).—III. Observations with an electron microscope on the $\alpha \rightleftharpoons \beta$ transformation in Zr are described and illustrated. On cooling the β-crystallites, having an "equiaxed" texture, below the transition point (865°), a martensitic α-texture appears; the original β-crystallites are replaced by regions of parallel lamellæ. On re-transformation the β-crystallites reappear, and almost the same lamellar pattern is formed when the specimen is again cooled. These observations support the conclusion that the transition occurs through a homogeneous transformation, by shearing and dilatation of coherent lattice regions parallel to definite crystallographic directions. The process thus resembles the formation of martensite in steel. Above 1150° the β-crystallites show rapid growth phenomena; the capacity for growth of any individual crystallite may be reversed by a temporary transition into the α-form. This is probably due to lattice distortions and stresses between neighbouring crystallites, set up by the successive transitions. During evaporation of the Ba activator from Zr at 600—700°, reversal of the relative intensities of emission of neighbouring crystallites is observed.

IV (cf. A., 1936, 1188). If a Sr–SrO activator is deposited on a Ni–Fe cathode at 900°, previously activated with Sr and Ba, an abnormal increase of emission intensity occurs along definite lines, the lines in each crystallite being parallel, and related in direction to the underlying crystal lattice. The formation of the lines is attributed to increased adsorptive power for the activating atoms in the neighbourhood of surface irregularities. A. J. E. W.

Structure of boron hydrides. V. Tetraborane B_4H_{10} and the pentaborane B_5H_{11}. S. H. BAUER (J. Amer. Chem. Soc., 1938, **60**, 805—812; cf. A., 1938, I, 236).—Electron-diffraction investigation shows that B_4H_{10} has a configuration analogous to that of C_4H_{10}, with the interat. distances B—B $1{\cdot}84 \pm 0{\cdot}04$, B—H $1{\cdot}28 \pm 0{\cdot}03$ A. B_5H_{11} has a structure similar to that of either *n*- or *iso*-C_5H_{12}, with B—B $1{\cdot}81 \pm 0{\cdot}03$ and B—H $1{\cdot}26 \pm 0{\cdot}03$ A. The valency angles are approx. tetrahedral; internal rotation must be assumed. The general formulation of the constitution of B hydrides is discussed. E. S. H.

Oxidation of aluminium foils. K. TANAKA and H. KANO (Mem. Coll. Sci. Kyoto, 1938, **A**, **21**, 1—4).—The structure of the film of γ-Al_2O_3 formed on heating Al foil has been examined by electron diffraction. On gradual heating some cubic crystals of γ-Al_2O_3 are formed and are oriented in the same way as the cubic crystals of Al in the original foil. When the foil is suddenly heated (900°) this effect is not observed. A. J. M.

Domain theory of ferromagnetics under stress. II. Magnetostriction of polycrystalline material. W. F. BROWN, jun. (Physical Rev., 1938, [ii], **53**, 482—491; cf. A., 1937, I, 556).—Expressions are derived for the magnetostriction of polycryst. Fe and Ni when the domains are isotropic, and when they are cryst. and have (111) and (100) as the direction of easy magnetisation. Results are discussed and compared with experimental data. N. M. B.

Photochemical processes in crystals. R. HILSCH and R. W. POHL (Ann. Physik, 1938, [v], **32**, 155—160; cf. A., 1938, I, 120).—The variation with temp. of the quantum efficiency of the decomp. of mixed crystals of KBr–KH and KBr–KD is described. Decomp. takes place at lower temp. for KBr–KH. The absorption bands of RbBr and RbH are compared. The positions of the bands are in agreement with vals. calc. on the hypothesis that light absorption gives rise to the transference of an electron from anion to cation. O. D. S.

Effect of hydrostatic pressure on the susceptibility of Rochelle salt. D. BANCROFT (Physical Rev., 1938, [ii], **53**, 587—590; cf. A., 1935, 288).—An investigation of the electric susceptibility as a function of temp. and pressure in the range −20° to 60° and up to 10,000 atm. shows that both the upper and lower crit. temp. are altered by the pressure, but the pressure coeffs. for the alterations are different in the two cases. An attempt to correlate the experiment with statistical mechanical theory is made. N. M. B.

Piezo-electric relaxation time in Seignette salt crystals. R. D. SCHULVAS-SOROKIN (Physikal. Z. Sovietunion, 1937, **12**, 685—700; cf. A., 1935, 288).—The variation of piezo-electric modulus with frequency has been measured, and also the changes of

relaxation time with temp. and the effect of an electric field. The connexion between mechanical and electrical relaxation time is discussed with reference to the mechanism of polarisation in the crystal. J. A. D.

Velocity of grain growth in aluminium. M. KORNFELD and F. RIBALKO (Physikal. Z. Sovietunion, 1937, **12**, 658—666; cf. A., 1935, 433).—New grains develop with anistropic velocity during the recrystallisation of plastically deformed single crystals of Al. They join to the octahedral planes of the mother-crystal with different irrational plane indices. The anisotropic growth occurs within a narrow temp. range and vanishes at high temp. J. A. D.

Mol. wt. of phosphorus pentoxide between 670° and 1100°. E. V. BRITZKA and E. HOFFMANN (Monatsh., 1938, **71**, 317—324).—Determination of the v.d. of P_2O_5 gives the following mean vals. for the mol. wt. at the temp. stated: 670°, 304; 870°, 303; 1000°, 291; 1100°, 301. (P_4O_{10} requires 284.) A. J. M.

Absolute measurement of resistance and reactance at frequencies of the order 300 × 10^6 cycles per sec. R. A. CHIPMAN (Physical Rev., 1938, [ii], **53**, 672). N. M. B.

Magnetic variation of the resistance of pure metals. M. KOHLER (Ann. Physik, 1938, [v], **32**, 211—218).—Theoretical. O. D. S.

Variation of the thermal resistance of pure metals in a transverse magnetic field. E. GRÜNEISEN (Ann. Physik, 1938, [v], **32**, 219—224).—Theoretical. The conclusions of Kohler (cf. preceding abstract) are valid also for the variation of the thermal resistance of metals in a magnetic field. O. D. S.

Electrical resistance of gold below 1° K. W. J. DE HAAS, H. B. G. CASIMIR, and G. J. VAN DEN BERG (Physica, 1938, **5**, 225—229; cf. A., 1937, I, 504).—A rapid increase in ρ occurs below 1° K., the results suggesting that ρ is infinite at 0° K. A. J. E. W.

Influence of transverse magnetic field on the electrical and thermal conductivity of pure metals at low temperature. E. GRÜNEISEN and H. ADENSTEDT (Ann. Physik, 1938, [v], **31**, 714—744).—The electrical and thermal conductivities of pure, and in most cases single-crystal, Cu, Ag, Pt, W, and Be have been measured in magnetic fields up to 12 × 10^3 oersted at −253° and also at −195° for Be. Results are discussed. O. D. S.

Magnetic properties of small pieces of metal at low temperatures. F. HUND (Ann. Physik, 1938, [v], **32**, 102—114).—Theoretical. An intermediate state of strong diamagnetism bounded by states of magnetic instability is to be expected in metals at very low temp. (cf. A., 1934, 19). In ring-shaped pieces of metal such diamagnetism will be accompanied by a current around the ring (cf. London, A., 1938, I, 19). O. D. S.

Cooling by adiabatic demagnetisation. P. DEBYE (Ann. Physik, 1938, [v], **32**, 85—101).—Theoretical. A limit exists at some thousandths °K. to cooling by the adiabatic demagnetisation of compounds possessing electronic magnetism. The magnetic properties of the alums, and especially $(NH_4)_2Fe(SO_4)_2$, at low temp. are discussed. O. D. S.

Thermodynamics of superconductivity. M. VON LAUE (Ann. Physik, 1938, [v], **32**, 71—84).—Theoretical. O. D. S.

Intermediate state of superconductors. L. LANDAU (Nature, 1938, **141**, 688).—It is calc. that the laminæ (A., 1937, I, 404) of the intermediate state of superconductors become thinner towards the surface, and finally form a kind of mixed phase. L. S. T.

Experiments at radio frequencies on superconductors. F. B. SILSBEE, F. B. BRICKWEDDE, and R. B. SCOTT (J. Res. Nat. Bur. Stand., 1938, **20**, 109—123).—A detailed account of work already noted (A., 1938, I, 129). J. A. D.

Magne-crystallic action. V. Paramagnetic salts of the rare-earth and iron groups. K. S. KRISHNAN and A. MOOKHERJI (Phil. Trans., 1938, **A, 237**, 135—159; cf. A., 1936, 1057).—Crystallographic data and full data for measurements on the magnetic anisotropy and mean susceptibility of 53 paramagnetic crystals are tabulated. Results are discussed on the basis of the theory of Van Vleck, Penney, and Schlapp, in relation to the Stark splitting of the energy levels of the paramagnetic ions under the influence of the strong cryst. electric fields acting on the ions. The contrast in the magnetic behaviour of the six-co-ordinated and the four-co-ordinated Co compounds, predicted by theory, is verified experimentally. The former salts are strongly, and the latter feebly, anisotropic magnetically. All salts of the Fe group (except Co salts) have two of their principal susceptibilities nearly equal; the magnetic ellipsoids approximate to a spheroid. The consts. of the crystal field in Ni salts are calc. in detail. N. M. B.

Paramagnetism of cupritetrachlorides and organic cupritrichlorides. J. AMIEL (Compt. rend., 1938, **206**, 1113—1115; cf. A., 1938, I, 207).—Vals. of χ at 20° are recorded for 28 complexes formed by $CuCl_2$ with amines and other N bases. In most cases the paramagnetism is approx. that to be expected for the $Cu^{..}$ ion. H. J. E.

Magnetic susceptibility of metallic cerium. R. JAANUS (Physikal. Z. Sovietunion, 1937, **12**, 729—735).—The magnetic behaviour of a weak magnetic material which has a ferromagnetic inclusion is discussed. A method of measurement is indicated which will allow the presence of the ferromagnetic impurity to be detected, and allowed for, in estimating the susceptibility of the sample. Previous measurements of the susceptibility of Ce at low temp. are considered untrustworthy. J. A. D.

Dispersion of acoustic velocity in liquids. B. V. R. RAO (Proc. Indian Acad. Sci., 1938, **7, A**, 163—176).—The results previously reported (cf. A., 1937, I, 353) have been amplified by a theoretical discussion and a description of experimental method. Dispersion of acoustic velocity with frequency has been established in the case of CCl_4 and $COMe_2$. The ultrasonic velocities for these liquids are re-

spectively 928 and 1205 m. per sec., and the hypersonic velocities 1070 and 978 m. per sec. Although the presence of similar dispersion in the case of C_6H_6 and PhMe is indicated, the data are not accurate enough for calculation of vals. for the supersonic and hypersonic velocities. C. R. H.

Absorption of untrasonic vibrations in solids and liquids. N. F. OTPUSCHTSCHENNIKOV (Physikal. Z. Sovietunion, 1937, **12**, 736—744).—A new method of measuring absorption of ultrasonic vibrations is described and is used to measure the absorption in Hg, H_2O, transformer oil, and vaseline oil. H_2O has the least, and petroleum oil the greatest, absorption. The results differ from the vals. calc. from Stokes' formula. Absorptions in steel, brass, NaCl, Cu, Sn, and glass were also measured. J. A. D.

Absorption of ultrasonic waves in liquids by an optical method. H. GROBE (Physikal. Z., 1938, **39**, 333—338).—An optical method for the investigation of the absorption of ultrasonic waves in liquids at various frequencies is described. The absorption in C_6H_6 for frequencies of 6—43 mHz., and in CCl_4, PhMe, EtOH, H_2O, and glycerol in the upper part of this range, was determined. The absorption in mixtures of C_6H_6 and $C_{10}H_8$, and of C_6H_6 and PhMe, was also determined as a function of concn. A. J. M.

Propagation of ultrasonic waves in liquids under pressure. P. BIQUARD (Compt. rend., 1938, **206**, 897—899; cf. A., 1934, 1299; 1938, I, 71).—The velocity of sound (V) in C_6H_6, PhMe, MeOAc, and CCl_4, at pressures (p) $\geq$700 kg. per sq. cm., and for a frequency of 10,000 kc. per sec., has been measured. In this range V shows a linear relation to p, except for C_6H_6 at p >400 kg. per sq. cm. (cf. A., 1929, 637). A. J. E. W.

Liquid jets with supersonic velocities. R. KLING and N. MANSON (Compt. rend., 1938, **206**, 892—894).—Shadow photographs of jets of gas oil, EtOH, H_2O, and glycerol, projected at high velocity into the atm., are discussed. A. J. E. W.

Influence of a magnetic field on the absorption of sound in oxygen gas. A. VAN ITTERBEEK and L. THYS (Physica, 1938, **5**, 298—304; cf. A., 1937, I, 230).—At 20° the absorption coeff. of sound in O_2 at 1 atm. pressure decreases by ~20% when a transverse magnetic field of 6000 gauss is applied. The effect disappears for pressures <0·3 atm. at 20°, and at lower pressures at 50°. The decrease is probably due to the effect of the magnetic field on the vibrational state of the O_2 mol. The velocity of sound in O_2 is unchanged by a magnetic field. The effect is not found with N_2, in which sound absorption varies with pressure in accordance with the Kirchhoff–Helmholtz formula. A. J. E. W.

Optical properties of very thin sheets of platinum. P. ROUARD (Compt. rend., 1938, **206**, 1106—1108; cf. A., 1937, I, 228).—Data are recorded for the transmission, reflexion, and phase change on reflexion of λ 5780 A. with Pt films of thickness 0·6—57·8 mμ. H. J. E.

Specific heats of zirconium and magnesium nitrides. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 399—405).—The mean sp. heats of Zr_3N_2 and Mg_3N_2 have been measured over three temp. ranges, and expressions derived for the true sp. heats over the total ranges (0—500° for Zr_3N_2 and 0—400° for Mg_3N_2). T. H. G.

Specific heat of βγ-butanediol. M. A. CHOCHLOVKIN and A. V. KALATSCHEVA (Sintet. Kautschuk, 1936, No. 1, 25—27).—Data for the pure and technical products at 26—140° are given. For the former the sp. heat, C, is given by $C = 0{\cdot}5381 + 0{\cdot}0010464t$, and for the latter by $C = 0{\cdot}5568 + 0{\cdot}001563t$, where t is the temp. CH. ABS. (*e*)

Specific heats of liquids in relation to Raman effect data. S. BHAGAVANTAM (Proc. Indian Acad. Sci., 1938, **7**, **A**, 245—250).—Vals. of C_v for liquid CCl_4 and CS_2 are midway between vals. calc. by two alternative methods. In one method, in evaluating the contribution of translational and rotational degrees of freedom, the substance is considered as a solid, and in the other as a gas. The observed val. for liquid C_6H_6 is closer to the val. calc. on the assumption of a solid than to the val. calc. on the assumption of a gas. It is concluded that in liquids thermal movements of mols. are partly in an organised manner constituting Debye elastic waves as in a solid, and partly in a random manner as in a gas. C. R. H.

Molecular heats of organic vapours. K. BENNEWITZ and W. ROSSNER (Z. physikal. Chem., 1938, **B**, **39**, 126—144).—Mol. heats C_p and heats of vaporisation have been determined by a new method for some 20 substances containing C, H, and O. A semi-theoretical expression has been derived by which C_p and dC_p/dT (for a limited temp. range) can be calc. for any temp. from the structural formula. Good agreement is obtained with recorded vals. T. H. G.

Thermodynamic treatment of stationary processes in multiphase systems. W. MEISSNER (Ann. Physik, 1938, [v], **32**, 115—127).—The thermodynamic equations necessary for the treatment of stationary processes in multiphase systems are derived and are applied to the technical manufacture of solid CO_2 and ice. The treatment of turbulent processes is discussed. O. D. S.

Restricted rotation in ethyl alcohol, acetone, and *iso*propyl alcohol. S. C. SCHUMANN and J. G. ASTON (J. Amer. Chem. Soc., 1938, **60**, 985—986).—Discrepancies between entropies calc. from mol. data assuming free rotation and experimental third-law entropies are traced to neglect of potentials restricting internal rotations. E. S. H.

Condensation and adsorption of mercury vapour. R. C. MASON (J. Appl. Physics, 1938, **9**, 131—134).—A study of the crit. temp. for condensation of Hg on a glass surface shows that a large nucleus is necessary for condensation to start. The heat of vaporisation of an atom from the nucleus is 13·2 kg.-cal. per mol. Hg atoms are adsorbed on glass rapidly at first and later slowly. E. M. W.

Vapour density of butadiene. M. A. CHOCHLOVKIN and A. V. KALATSCHEVA (Sintet. Kautschuk,

1936, No. 1, 28—30).—The wt. of 1 litre of butadiene at n.t. was 2·4787 g. The mol. vol. at n.t. was 21·81. CH. ABS. (*e*)

Vapour pressure of corrosive substances. IV. K. ARII and M. KAWABATA (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 299—308).—Using Jackson's glass-spring manometer the v.p. of PBr_3 has been measured from 40° to its b.p. and of PCl_3 from −20° to 70°. Empirical equations connecting v.p. and temp. are given for each. The following consts. are recorded for PBr_3 and PCl_3, respectively: latent heat of evaporation at b.p. 9704 g.-cal., 7414 g.-cal.; mean heat of evaporation over the range studied 9789 g.-cal., 7584 g.-cal.; b.p./760 mm. 172·8°, 74·7°. Trouton's const. shows that both are normal liquids. The f.p. of PCl_3 is −93·6°. T. H. G.

Thermal expansion of the alkalis. L. BALAMUTH (Physical Rev., 1938, [ii], **53**, 669).—The combination of an equation due to Bardeen for the energies of the alkali metals with Debye's idea that the thermal expansion of a solid is determined by the anharmonic terms in the potential energy allows the expansions to be calc. Results for Na are in satisfactory agreement with observed vals. N. M. B.

General definition of entropy and the bases of chemical thermodynamics. W. MUND (Ann. Soc. Sci. Bruxelles, 1938, **58**, [i], 65—86; cf. A., 1936, 681).—Non-uniform systems, for which a generalised Clausius theorem is required, are specially considered. I. McA.

Thermodynamic properties of the hexyl alcohols. II. Hexan-α-, -β-, and -γ-ol, and β-methylpentan-α- and -δ-ol. F. HOVORKA, H. P. LANKELMA, and S. C. STANFORD (J. Amer. Chem. Soc., 1938, **60**, 820—827; cf. A., 1934, 136).—Viscosity, surface tension, v.p., and *d* of the alcohols have been determined at temp. from 5° to the b.p. The b.p., heats of vaporisation, and Rankine equation consts. have been calc. from the v.-p. measurements, and the parachors, Eötvös consts., and crit. temp. from the surface tension data. E. S. H.

Thermodynamic properties of substances as a function of reduced temperature. I. Latent heat. Vapour volume and vapour pressure of water. II. Vapour pressures of liquids and the principle of corresponding states. H. A. FALES and C. S. SHAPIRO (J. Amer. Chem. Soc., 1938, **60**, 784—794, 794—805).—I. Theoretical. Relations between latent heat, pressure, vol., and reduced temp. have been formulated and tested in respect of published data.

II. The equation for reduced pressure has been applied to published data for 30 substances. At equal reduced temp. the reduced v.p. of two substances are related. The relating coeffs. are exponential functions of temp., and become = 1 at the crit. point. E. S. H.

Preparation for the formation of new phases. A. SMITS (Z. physikal. Chem., 1938, **B**, **39**, 50—58).—Theoretical. The part played by "pseudo-association" in the appearance of new phases is discussed. New investigations of the *X*-ray and Raman spectra of liquid H_2O confirm conclusions drawn from the author's theory of allotropy. J. W. S.

Thermal conductivity of crystals at low temperatures. W. J. DE HAAS and T. BIERMASZ (Physica, 1938, **5**, 320—324).—Previous results (A., 1935, 1064; 1937, I, 506; 1938, I, 131) are summarised and discussed. The dependence of the conductivity of KCl and SiO_2 at temp. <20° K. on the size of the specimen crystal has been confirmed. This phenomenon is attributed to the reflexion of elastic waves at the crystal boundaries. A. J. E. W.

Measurements on the heat-conductivity of liquid helium II. W. H. KEESOM, (MISS) A. P. KEESOM, and B. F. SARIS (Physica, 1938, **5**, 281—285; cf. A., 1936, 788).—k for liquid He II in a long capillary has been found to vary with the heat flow, k decreasing with increasing flow rate. Pronounced max. vals. of k, attaining 810 c.g.s. units, are observed at 1·7—2·0° K. A. J. E. W.

Joule and Joule–Thomson effects. A. L. CLARK and L. KATZ (Canad. J. Res., 1938, **16**, **A**, 41—59).—The val. of the internal pressure (Joule effect) calc. from available data for the two-phase liquid–vapour state is an approx. linear function of the external pressure. The val. of the internal pressure has also been calc. for low pressure. The variation of c_v with temp. has been related to the behaviour of the internal pressure. At const. temp. the internal pressure rises to a max. with increase of pressure and probably falls to zero and becomes negative. For He the pressure for inversion is relatively low. The inversion curve for the Joule–Thomson effect has also been studied and it is shown that even for CO_2 an inversion may be expected. Calculation of the two effects is reliable as long as the vals. are large. D. F. R.

Relativistic study of Joule–Thomson effect and adiabatic processes in a gas. I. D. V. GOGATE (Phil. Mag., 1938, [vii], **25**, 694—702).—Theoretical, deriving $pr^{V4/3}$ = const. H. J. E.

Determination of intermolecular forces from the Joule–Thomson coefficients. J. O. HIRSCHFELDER, R. B. EWELL, and J. R. ROEBUCK (J. Chem. Physics, 1938, **6**, 205—218).—The energy of interaction between non-polar mols. is determined inductively from the experimental Joule–Thomson coeffs. He and A are studied in detail. W. R. A.

Measurements on the viscosity of helium gas between 293° and 1·6° K. A. VAN ITTERBEEK and W. H. KEESOM (Physica, 1938, **5**, 257—269).—Vals. of η obtained by an oscillating-disc method are recorded; the dependence of η on T is in agreement with Uchling's theory (A., 1933, 551; 1935, 157). At 423 and 20·38° K., η remains const. within 1% with change of pressure (p) down to approx. 2 mm. For lower pressures, $\eta = \eta_\infty p/(\eta_\infty a + p)$, a being a const. parameter and η_∞ the const. val. of η at higher pressures. The ratio of the vals. of a at 4·23 and 20·38° K. is in agreement with the val. calc. by assuming Maxwell velocity distribution. A. J. E. W.

Viscosities of hydrocarbons. I—III. E. B. EVANS (J. Inst. Petroleum Tech., 1938, **24**, 38—53).—Published data on the η of hydrocarbons are critically reviewed. In the measurement of η, a modified B.S.I. viscometer was used, designed to reduce kinetic energy effects and to render the instrument suitable for liquids of very low η. The errors met with in small viscometers are attributed entirely to drainage effects and not to γ. Abs. and kinematic η are tabulated for *n*-paraffins from C_4H_{10} to $C_{18}H_{38}$ and for dotriacontane. C. C.

Internal friction in solids. IV. Relation between cold work and internal friction. C. ZENER (Physical Rev., 1938, [ii], **53**, 582—586; cf. A., 1938, I, 131).—Mathematical. It is assumed that the effect of cold work on internal friction is due to residual internal stresses produced. These, during vibration, give rise to temp. fluctuations and thus to local heat currents associated with a rise in entropy or internal friction. A formula for this internal friction in terms of the energy associated with the residual stresses and the temp. variation of the modulus of rigidity is obtained; it gives the observed order of magnitude. N. M. B.

Physico-chemical studies of dioxan–water mixtures. L. W. ÖHOLM (Finska Kem. Medd., 1938, **67**, 19—39).—Measurements of *d*, η, n_D, and Δ have been made at 20°. For solutions of electrolytes Δ, α, and κ decrease rapidly with increasing dioxan concn. M. H. M. A.

Viscosity of binary mixtures. B. M. GUGEL (J. Phys. Chem. Russ., 1938, **11**, 105—108).—The empirical equations of Batschinski (1921), Meyer and Mylius (A., 1920, ii, 590), Ishikawa (A., 1929, 387), Weichherz and Gugel (A., 1937, I, 22), and Lutschinski (*ibid.*, 295) can be shown to be mutually transformable. J. J. B.

Diffusion and viscosity in binary liquid mixtures. H. LEMONDE (Ann. Physique, 1938, [xi], **9**, 539—644).—A detailed account is given of results previously reported (cf. A., 1937, I, 295, 405). The relations are discussed in some detail. N. M. B.

Nuclear formation in the separation of metallic mixed crystals. R. BECKER (Ann. Physik, 1938, [v], **32**, 128—140).—Approx. vals. are calc. of the work of formation of a nucleus and of the probability of nuclear formation in a supersaturated binary mixed crystal. The derived temp. of max. velocity of separation is in agreement with experiment. O. D. S.

Manganese–bismuth alloys. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 343—344).—Microscopical observations show that alloys corresponding with $MnBi_2$ and $MnBi_3$ consist of crystals of Bi in a ground-mass of MnBi. E. S. H.

Magnetic and *X*-ray investigations with nickel–platinum alloys. A. KUSSMANN and H. NITKA (Physikal. Z., 1938, **39**, 373—375).—The magnetic properties of Ni–Pt alloys and their *X*-ray structure have been examined over the entire range. A phase with superstructure is found at Ni_3Pt. It is formed from the mixed-crystal phase by tempering at 450°. Its electrical conductivity is > that of the mixed-crystal phase owing to the ordered arrangement of atoms. It also has a smaller magnetic saturation and a lower Curie point. A. J. M.

Electronic structure of alloys. T. MUTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 377—390).—Mathematical. T. H. G.

Theory of order for the copper–gold alloy system. W. SHOCKLEY (J. Chem. Physics, 1938, **6**, 130—144).—The order–disorder transformation for a wide range of composition has been determined on the basis of Bethe's assumption of nearest neighbour interaction. The connexion between the theories of Bethe and of Bragg and Williams is established. W. R. A.

Solubility of silver in mercury. III. R. J. MAURER (J. Physical Chem., 1938, **42**, 515—519).—The solubility or Ag in Hg at 5—20° shows only slight departures from the equation $\log N = -1105{\cdot}8/T + 0{\cdot}5894$ (A., 1933, 562). A sintered glass filter can be used to separate such amalgams. No evidence is obtained that Ag aggregates of various sizes are present. J. W. S.

Solubility of gold in mercury. IV. G. MEES (J. Amer. Chem. Soc., 1938, **60**, 870—871; cf. A., 1931, 794).—Data are recorded for the temp. range 190—300°. No max. occurs in this region. E. S. H.

Influence of various factors on the solubility of copper–zinc alloy in acid. I, II. H. KUGE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 417—433, 434—446).—I. The behaviour of Zn and of an alloy containing 90% Zn towards N-H_2SO_4 has been investigated between 30° and 80° and the results are discussed in relation to heat-treatment, surface area, grain size, and local galvanic action.

II. Pure Cu and alloys containing 10%, 20%, and 30% Zn have been examined after varying heat-treatment. Solubility appears to increase with grain size up to a limit and then remains const. An explanation is suggested. T. H. G.

Solubility of lime in water at different temperatures. M. M. POLJATSCHENKO (Zapiski, 1937, **4**, 44—45; Int. Sugar J., 1938, **40**, 150).—Solutions saturated with $Ca(OH)_2$ contain 0·13% CaO at 10°, 0·124% at 20°, 0·107% at 40°, 0·088% at 60°, and 0·068% at 80°. J. P. O.

Solubility of calcium carbonate in solutions of ammonium salts. G. EMSCHWILLER and G. CHARLOT (Compt. rend., 1938, **206**, 1115—1117).—For a given p_H in the range 7·8—7·4, the solubility of $CaCO_3$ in aq. NH_4Cl is 2—3·5 times that in aq. HCl. The enhanced solubility is due mainly to hydrolysis, but partly, also, to salt action. H. J. E.

Solubility of picric acid in water and aqueous electrolyte solutions. H. VON HALBAN and H. KORTSCHAK (Helv. Chim. Acta, 1938, **21**, 392—401).—Data (at 20°) are recorded for picric acid in H_2O and in aq. NaCl, NaBr, $NaClO_4$, $NaNO_3$, $LiClO_4$, $LiNO_3$, $Sr(NO_3)_2$, LiCl, LiBr, $CaCl_2$, $Ca(NO_3)_2$, HCl, HNO_3, and $HClO_4$, respectively. A slow reaction was noted with >0·8N-HNO_3. E. S. H.

Chemistry and electrochemistry of rhenium. VI. Solubility of potassium perrhenate in water between 10° and 518°. H. Hölemann and W. Kleese (Z. anorg. Chem., 1938, **237**, 172—176).—The m.p. of $KReO_4$ is 518°. The solubility in H_2O from 10° to 518°, and *d* for the saturated solution from 10° to 100°, have been determined. F. J. G.

Physico-chemical properties of solutions in liquefied gases. XXI. Liquid sulphur dioxide as a solvent for inorganic substances. A. I. Schattenstein and M. M. Victorov (J. Phys. Chem. Russ., 1938, **11**, 18—27).—Qual. solubility data are given for 87 substances. Quant. measurements are recorded for LiCl, LiBr, NaCl, NaBr, NaI, KCl, KBr, RbCl, CsCl, NH_4Cl, NH_4Br, CaI_2, and SrI_2. J. J. B.

Thermodynamical calculation of the solubility of some important sulphides up to 400°. J. Verhoogen (Econ. Geol., 1938, **33**, 34—51).—Calc. vals. for ZnS, PbS, HgS, CuS, Ag_2S, and Cu_2S indicate a considerable increase of solubility with temp., the ratio of the solubility at 400° to that at 25° ranging from 10^2 to 10^4, and reaching 10^7 for ZnS. Except for a Ag_2S–CuS reversal, the order of increasing solubility is the same at 400° as at 25°. A relation expressing changes in solubility with p_H has been developed. L. S. T.

Determination of reciprocal solubilities of water and an organic liquid by pyknometer and refractometer. A. Niini (Suomen Kem., 1938, **11**, **A**, 19—20).—An expression connecting *d* and *n* for binary liquid mixtures with the composition has been used to determine the reciprocal solubilities of H_2O and a no. of org. liquids. The calc. and observed vals. are in good agreement. M. H. M. A.

Adsorption of hydrogen on reduced nickel. Studies at low temperatures. S. Iijima (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 286—298).—Velocities of adsorption have been measured between −23° and −130°. Several activated processes occur simultaneously but can be represented by one equation. Velocity coeffs., heats of activation, and adsorption isotherms have been determined. The heat of adsorption is found to be 10,600 g.-cal. T. H. G.

Activated adsorption of methane on reduced nickel. M. Kubokawa (Proc. Imp. Acad. Tokyo, 1938, **14**, 61—66).—Between −112° and 20° adsorption is of the van der Waals type. At 40—250° activated adsorption occurs and the rate of this has been measured. After activated adsorption the initially desorbed gas is CH_4, but at later stages of desorption it is accompanied by increasing amounts of H_2, indicating a dissociative adsorption severing the C–H linking. E. S. H.

Adsorption of hydrogen by copper dispersed in magnesia. J. R. Lewis and H. S. Taylor (J. Amer. Chem. Soc., 1938, **60**, 877—879).—The adsorption of H_2 by Cu, MgO, and Cu–MgO has been determined at 1 atm. and 80—717° K. Adsorption is increased by dispersing Cu in MgO and the product is less likely to sinter than is pure Cu. Physical and activated adsorption processes occur in each case; with MgO they are separated by a wide temp. interval. E. S. H.

(A) Statistical mechanics of the adsorption of gases at solid surfaces. (B) Adsorption of argon, nitrogen, and oxygen on smooth platinum foil at low temperature and pressures. F. J. Wilkins (Proc. Roy. Soc., 1938, **A**, **164**, 496—509, 510—531).—(A) The adsorption isotherm is deduced in terms of the mol. concn. in the adsorbed and gaseous phases, the adsorption potential, and certain partition functions. These functions have been evaluated for (i) a three-dimensional gas, (ii) a gas of two-dimensional lateral mobility, and (iii) a Planck oscillator with three degrees of freedom. The relation between the adsorption potential and the differential heat of adsorption is discussed and the usual method of evaluating the latter is criticised.

(B) The adsorption of A, N_2, and O_2 on Pt foil is measured between 77° and 193° K. at pressures between 5×10^{-3} and 2×10^{-1} mm. Deviations from Langmuir's isotherm are found at the lower temp. The fraction of the surface covered at saturation is unity only for A at 77° K.; in all other cases it is $\ll$ unity, and is approx. $\propto \exp(-\beta/T)$. The failure of the Langmuir relation at low temp. is attributed to the intermol. forces which exert an influence on the amount of gas adsorbed. The adsorption potentials of A and N_2 are calc. from the results of the preceding paper and are compared with the vals. calc. from quantum mechanics. G. D. P.

Influence of the p_H of the medium on the hydrolytic adsorption. R. Bruns, R. Burstein, N. Fedotov, and M. Livschitz (J. Phys. Chem. Russ., 1938, **11**, 7—17).—An acid solution has been titrated potentiometrically with NaOH both in absence and in presence of platinised charcoal in a H_2 atm.; the difference of [H·] with and without C is a measure of the NaOH adsorbed. The adsorption rises with p_H and is zero at $p_H < 0{\cdot}4$. Adsorption of H_2SO_4 by platinised charcoal in O_2 becomes zero at $p_H > 8{\cdot}8$. Adsorption of NaOH by sugar charcoal in O_2 is zero at $p_H < 1{\cdot}8$, and by SiO_2 gel at $p_H < 8$. SiO_2 gel in H_2 does not accelerate the inversion of sucrose. J. J. B.

Traube's rule in adsorption from solutions. K. A. Pospelova (J. Phys. Chem. Russ., 1938, **11**, 99—104).—The adsorption by quartz from aq. solutions rises in the series MeOH < $Pr^{\alpha}OH$ < $Bu^{\alpha}OH$ < *iso*-C_5H_{11}·OH < C_6H_{13}·OH and $Bu^{\alpha}CO_2H$ < C_5H_{11}·CO_2H < C_6H_{13}·CO_2H. From gasoline $EtCO_2H$ is more readily adsorbed than $Pr^{\alpha}CO_2H$; $Bu^{\alpha}CO_2H$ and C_5H_{11}·CO_2H are not adsorbed. This deviation from Traube's rule is explained by an inverse orientation of acid mols. at the quartz–gasoline interface. J. J. B.

Adsorption on curved surfaces and emulsification. H. M. Cassel (J. Physical Chem., 1938, **42**, 475—482).—The thermodynamic theory of adsorption on curved surfaces is developed. It is suggested that emulsions can be stable only if the interfacial density of the emulsifying films for surfaces of larger curvature is > for those of less curvature. Deductions

from the theory are in qual. agreement with experiment. J. W. S.

Adsorption of solvents by soluble substances. Heat evolved by adsorption preceding dissolution. E. CALVET (J. Chim. phys., 1938, **35**, 69—79).—The heats of adsorption of the vapours of H_2O, EtOH, $COMe_2$, C_6H_6, CCl_4, C_6H_{14}, and CS_2 on $CO(NH_2)_2$, NH_2Ac, NH_2Bz, sucrose, $C_{10}H_8$, and I are recorded. The heats of adsorption of H_2O on $CO(NH_2)_2$ and NH_2Ac are approx. equal to the heats of dissolution. C. R. H.

Clay. I. Behaviour of dyes and of organic compounds capable of forming salts towards clay and related substances. II. Behaviour of essential oils and their components towards clay and related substances. H. CARLSOHN and G. MÜLLER (Ber., 1938, **71**, [*B*], 858—863, 863—870).—I. Adsorption of Sudan-red *B* (I) by substances which do not contain acidic groups (Al_2O_3, $CaCO_3$) occurs without change of colour and the dye can be removed by much solvent. Air-dried, natural bleaching earths and other clays afford red adsorbates. Artificial bleaching earths activated with mineral acids yield very stable adsorbates with formation of salts, production of which is not due to incompletely removed acid. In the region of loosely-bound H_2O absorption of the dye by artificial clays is a time reaction which proceeds more rapidly as the H_2O content diminishes. Action consists in the displacement of the H_2O by solvent and dye. The change occurs somewhat differently with clays which have been dehydrated at room temp. in a vac. and those which have been dried at 100—400°/atm. pressure. In the region of chemically united H_2O (>400°) the (I) reaction decreases with diminishing H_2O content and becomes negative at about 700°. The activity of the product is not restored by contact with H_2O. Floridin (II), after desiccation, gives a blue adsorbate with (I) in light petroleum; this is stable only in presence of the solvent. With benzanthrone (III) in C_6H_6, (II) yields an adsorbate with green fluorescence whereas artificial activated clays give red-orange to golden-yellow fluorescence colours according to their content of loosely-combined H_2O. Strongly adsorbed solvents displace the dye from the surface of the adsorbent. The dependence of the activity and stability of the clay complex on the H_2O content and thermal treatment of the adsorbent is similar with (I) and (III).

II. 1 c.c. of the substance is mixed with 0·5 g. of highly active franconit at 20° in a test-tube wrapped with cotton-wool and provided with a thermometer; the max. temp. attained are recorded. The temp. effects of many unsaturated alcohols and aldehydes are of the same order as those due to simple adsorption although the compounds are considerably altered. The greatest effects are observed with linalool and citronellal. Esters show somewhat greater effects than those of the corresponding alcohols. The behaviour of hydrocarbons appears to be governed by the nature and position of the double linkings in the mol. The effect of feebly adsorbed solvents on the catalytic reaction is scarcely noticeable. With EtOH, MeOH, and $COMe_2$ the catalytic change is completely inhibited and the temp. effects are solely those due to the action of the solvent on the particular clay. The importance of this protective action for the stabilisation of essential oils within the plant is discussed. The analysis of essential oils by treatment with natural franconit (devoid of catalytic properties) after the pattern of chromatographic analysis is described. H. W.

Periodical sedimentation from solution during evaporation of the solvent. N. F. JERMOLENKO and K. I. BURANKOVA (J. Phys. Chem. Russ., 1938, **11**, 149—154).—Borax is deposited in rings from H_2O and alcohols. The distances between the rings increase with increasing surface tension of the solvent, with falling temp., falling concn. (down to 0·01%), and increasing bore of the capillary. This behaviour agrees with the theory that the rings are produced because the solution is suspended by capillary forces on the first ring until the wt. of the suspended liquid becomes too large; then the liquid suddenly drops to a new level where the formation of a second ring starts. J. J. B.

Theory of surface tension of aqueous solutions. M. DOLE (J. Amer. Chem. Soc., 1938, **60**, 904—911).—A general equation for the surface tension of salt solutions has been derived, using a modified form of the Langmuir hyperbolic adsorption equation, and assuming that negative ions are adsorbed at the boundary at a limited no. of points and that at all other points positive and negative ions are excluded from the first adsorption layer. The theory explains certain anomalies in published data. E. S. H.

Interfacial tensions of some mercury–hydrocarbon oil systems. II. J. L. CULBERTSON and K. D. LUEDTKE (J. Physical Chem., 1938, **42**, 469—473; A., 1937, I, 300).—The method of Bartell and Miller (A., 1928, 945) has been applied to interfaces between Hg and oils. The tensions are lowered by the presence of EtBr or PhBr, which are probably adsorbed in the surface. J. W. S.

Measurement of very small surface pressures. J. GUASTALLA (Compt. rend., 1938, **206**, 993—995).—Small surface pressures in unimol. films are measured by the curvature of a silk fibre under known tension, which forms a boundary of the film. Isotherms connecting the pressure with the surface area per mol. are given for trioctoin (I), trihexoin, and oleic acid; only (I) obeys Boyle's law. A. J. E. W.

Theoretical considerations relative to capillary rise, wetting phenomena, and Antonow's rule. F. J. NELLENSTEYN (Chem. Weekblad, 1938, **35**, 283—288).—It is suggested that Antonow's rule (the interfacial tension between two liquid phases = the difference of the surface tensions) is a special case of the general law, that in the systems liquid–liquid–gas, solid–liquid–liquid, and solid–liquid–gas, the surface energies of the mutually saturated phases are such that one of these quantities is always equal to the sum of the other two. Three equations are derived, giving the conditions which correspond with complete, partial, and non-wetting. Exceptions are to be expected if the surfaces contain oriented mols. S. C.

Spreading of certain substances on a clean surface of water. I. L. A. RAMDAS and P. S. VAIDYANATHAN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 186—195).—The rate of surface dissolution, R, of camphor (I) floating on H_2O is > the rate of internal dissolution. R varies linearly with the perimeter of contact and appears to be independent of the surface area and depth of the H_2O. Evaporation from H_2O on the surface of which is a unimol. layer of (I) is > from pure H_2O. This is possibly due to convection currents tending to equalise the temp. of H_2O at and below the surface, thereby increasing the surface temp. C. R. H.

Influence of surface structure of a metal on the spreading and orientation of polar molecules. J. J. TRILLAT and R. FRITZ (J. Chim. phys., 1938, **35**, 45—57).—A polished Fe surface is not wetted by molten stearic acid, but when roughened the amount of wetting increases with the coarseness of the surface, and is greater when the roughening has been carried out transversely than when it has been done longitudinally. When the polished surface is oxidised, corroded by treatment with acid, or covered with a thin layer of graphite, the wetting power is increased. C. R. H.

Dynamics of liquid movements in capillary systems (Lloyd effect). W. OSTWALD and H. ERBRING (Kolloid-Z., 1938, **83**, 13—19).—When a cylinder containing a solution is connected to one containing the solvent by a strip of filter-paper the ends of which dip into the respective liquids, the level of the solvent falls and that of the solution rises. The effect is increased by raising the concn. of the solution, by lengthening the connecting strip, and in other ways. It is not due to isothermal distillation or to differences of surface tension, but represents a siphon effect. F. L. U.

Capillary systems. XX (1). Dynamics of the capillary siphon. XXI (1). Localised reactions in a field of diffusion or of flow. E. MANEGOLD and K. SOLF (Kolloid-Z., 1938, **83**, 19—23, 24—30).—XX. If a vessel containing H_2O is connected with one containing an aq. solution by a siphon filled with H_2O, transference of H_2O to the solution (cf. preceding abstract) occurs as a result of diffusion of the solute into one limb of the siphon causing a difference of density. By measuring the velocity of transference the diffusion coeff. of the solute may be calc. Examples are given.

XXI. Instances of reactions in which one reactant is fixed in position whilst the other is in process of flow or diffusion are discussed. A model of reactions of the type A (fixed) + (B + C) (moving) is given and treated mathematically. F. L. U.

Capillary systems. XII (5). Cylindrical sphere-screws of any pitch. Torsion of sphere-screws. Sphere-screws as models for phyllotaxis. E. MANEGOLD and H. LINDEMANN. (6) Characterisation of the screw linkage in interpenetrating cylindrical and elliptical screws. E. MANEGOLD (Kolloid-Beih., 1938, **47**, 196—224, 225—253; cf. A., 1935, 443).—Mathematical. F. L. U.

Drop phenomenon. W. RIEDEL (Kolloid-Z., 1938, **83**, 31—32).—Under certain conditions a drop of liquid falling into the same liquid in bulk can sink below the surface and slowly rise to the surface while maintaining its identity. In such a case the drop is separated from the bulk liquid by a layer of air, the thickness of which, for 0·5% Na oleate, is of the order 5×10^{-4} cm. The phenomenon is not observed with H_2O. F. L. U.

Nature of sliding and the analysis of friction. F. P. BOWDEN and L. LEBEN (Nature, 1938, **141**, 691—692).—Experiments with an apparatus which records fluctuations in frictional force show that this force is not const. but fluctuates violently. Sliding is not a continuous process, but proceeds by an alternation of "stick and slip." Metallic and other surfaces, prepared and polished in different ways, show the phenomenon to be a general one. Behaviour may be essentially the same even after lubrication; certain long-chain fatty acids, however, cause continuous sliding. Surface temp. remains const. during "stick," but rises rapidly at the instant of "slip," and then falls. L. S. T.

Application to flotation of Curie's law of the growth of crystal faces. F. BARILLET and (MLLE.) A. CHOISNARD (Compt. rend. XVII Cong. Chim. Ind., 1937, 525—529; cf. A., 1937, I, 359).—The parallelism shown by capillary consts. and degree of supersaturation in relation to the rate of crystal growth from solution (i) under equilibrium conditions (Curie), and (ii) with rapid growth but with negligible diffusion (Valeton), suggests that interfacial tension at all crystal faces is increased (unequally) by supersaturation. Experiments on the distribution of fine-grained salts between non-miscible solvents, and observations on crystal flotation, confirm this view; its technical scope is indicated. I. McA.

Orientation of molecules and structure of fatty acid crystals. D. L. TALMUD (J. Phys. Chem. Russ., 1938, **11**, 158—159).—When palmitic acid crystallises on a H_2O surface it forms hydrated crystals of ρ 1·192. These crystals as well as the flakes pptd. by an acid from NH_4 palmitate solutions adsorb NH_3, electrolytes, etc. more readily than charcoal. J. J. B.

Dilatancy. E. J. W. VERWEY and J. H. DE BOER (Rec. trav. chim., 1938, **57**, 383—389).—The "liquefaction" on the addition of traces of oleic acid, of pastes of Fe, Ni, SiO_2, talc, Fe_2O_3, $BaCO_3$, or glass powders to CCl_4, C_6H_6, n-C_6H_{14}, or ligroin has been investigated, and the liquid masses so obtained have been examined for dilatancy phenomena. There is a strong parallelism between "liquefaction" and dilatancy. It is supposed that in a paste the solid particles adhere at several points due to van der Waals–London attraction forces and that the liquid fills up the interstices, the liquid mols. also being bound by the solid particles so that they act as bridges and thus increase the adhesion energy. Addition of oleic acid expels the liquid mols. if the polar forces between CO_2H groups and the surface of the solid particles are sufficiently large. The non-polar ends of the acid mols. are weakly bound to

the liquid mols. and to oriented acid mols. on adjacent particles, thus permitting sliding of the particles against each other, resulting in "liquefaction."
C. R. H.

Solvent effect in dielectric polarisation. III. Behaviour of ethyl alcohol in certain ethers. G. THOMSON (J.C.S., 1938, 460—464; cf. A., 1937, I, 507).—The variation of polarisation of EtOH in Pr^{β}_2O, Bu^{α}_2O, amyl ether, and dioxan with [EtOH] has been determined. The solutions in Pr^{β}_2O and dioxan show definite max. in the polarisation–concn. curves. The vals. of the polarisation at infinite dilution are high (in Pr^{β}_2O 91·9, Bu^{α}_2O 99·5, amyl ether 112, dioxan 79·2). These results can be explained by supposing that a H bond is formed between the ether and the alcohol, *i.e.*, $R_2O\cdots HOR$. Evidence for the formation of such bonds between ethers and alcohols is obtained from cryoscopic determinations with solutions of $C_{10}H_8$ and $C_6H_4(NO_2)_2$ in dioxan, C_6H_6 and C_6H_{14} in Et cetyl ether, and $C_{10}H_8$ in Ph_2O.
A. J. M.

Variation with concentration of the density and refractive index of very dilute aqueous solutions of strong electrolytes. Differential method for the determination of small differences in density. W. PRANG (Ann. Physik, 1938, [v], **31**, 681—713).—Measurements of d have been made, by the method described, for solutions of NaCl, KCl, Na_2SO_4, $MgSO_4$, Na_2CO_3, and K_2CO_3 at concns. from 0·0007N to 0·1N. The square-root law of Redlich and Rosenfeld (A., 1931, 905) is only approx. obeyed. Better agreement is obtained by treating separately results above and below ~0·01N. Deviations for Na_2CO_3 and K_2CO_3 are ascribed to hydrolysis and the degree of hydrolysis is calc. The variation of n for aq. solutions of Na_2CO_3 and K_2CO_3 with concn. from 0·003N to 0·09N has been investigated and equiv. refractivities have been calc. No anomalies were observed.
O. D. S.

Falkenhagen's theory of viscosity of dilute aqueous solutions of strong electrolytes. E. ASMUS (Z. Physik, 1938, **108**, 491—499).—Viscosities of $MgSO_4$, $CuSO_4$, and $ZnSO_4$ in dil. aq. solution are related to molar concn. Results for $CuSO_4$ and $ZnSO_4$ are in agreement with Falkenhagen's theory. In the case of $MgSO_4$, the discrepancy first noted by Cox and Wolfenden (A., 1934, 959) is confirmed.
L. G. G.

Experimental proof of Falkenhagen's theory of the viscosity of aqueous solutions of strong electrolytes. E. ASMUS (Naturwiss., 1938, **26**, 200).—The plot of $\psi = (\eta/\eta_0)-1$ against $c^{\frac{1}{2}}$ for $MnSO_4$ is a straight line except at very low dilutions. The extrapolated val. of A in the expression $\psi = A + Bc^{\frac{1}{2}} + Dc^{\frac{3}{2}}$ is 0·023. Similar results are given by $MgSO_4$.
A. J. M.

Viscosity and particle form. A. PETERLIN (Naturwiss., 1938, **26**, 168—169).—Theoretical. A method of calculating the sp. viscosity of dil. suspensions of solid, ellipsoidal, rotation-symmetrical particles is given for particles of diameter $<10^{-4}$ cm. but large with respect to solvent mols.
A. J. M.

Influence of a magnetic field on Brownian movement. C. SCHAEFER (Ann. Physik, 1938, [v], **32**, 190—194).—Theoretical. The influence of a magnetic field on Brownian rotation is discussed. It is shown to increase with increasing electrical conductivity and increasing radius of the particles. For Cu spheres of radius 6 μ. the effect of a magnetic field of 2×10^4 oersted would be equiv. to an increase of >10% in the viscosity of the supporting medium.
O. D. S.

Modification of the hydrogen-ion activity of metallic salt solutions by suspended substances. F. REIFF, R. NEUMANN, and R. A. J. SCHULZ (Z. anorg. Chem., 1938, **237**, 145—159).—The rate of inversion of sucrose in conc. salt solutions is much increased by suspended clays which have previously been treated with acids. The effect is not caused by acid absorbed by the clay, and only a part of it is caused by ion-exchange. The suggestion that it is due to the presence of an active surface is confirmed by the observation that a marked rise in temp. occurs when the clays are suspended in turpentine. Possible mechanisms are discussed.
F. J. G.

***X*-Ray diagram, double refraction, and viscosity of streaming sols.** K. HESS, H. KIESSIG, and W. PHILIPPOFF (Naturwiss., 1938, **26**, 184—186).—The results of the investigation of the double refraction, η, and *X*-ray diagrams of sols containing cryst. anisodiametrical particles are discussed. The double refraction of streaming sols indicates the form of streaming and the direction of orientation of the particles. Similar information is afforded by η, whilst *X*-ray data are determined by the structure and form of the particles and their no. as well as by the angle of orientation.
A. J. M.

Effect of ultrasonic waves on solutions of highly polymerised substances. E. THIEME (Physikal. Z., 1938, **39**, 384—390).—The effect of ultrasonic waves on the viscosity of solutions of gelatin, agar, and gum arabic has been investigated. The viscosity is decreased, the decrease being the greater the greater is the amplitude of the waves. The effect depends on concn. and reaches a max. which moves towards smaller concn. as the mol. wt. increases, and the amplitude of the waves decreases. The effect is the greater the higher is the mol. wt. The decrease in viscosity is not exponential in relation to the period during which the solution is submitted to the action of the waves, although the curve becomes more nearly exponential as the period of exposure is lengthened.
A. J. M.

Light-scattering in emulsions. I. Dilute simple emulsions. R. S. KRISHNAN (Proc. Indian Acad. Sci., 1938, **7**, **A**, 98—103; cf. A., 1935, 821).—Measurements of ρ_u, ρ_v, and ρ_h are made for dilute aq. emulsions, prepared by (i) dispersion, (ii) condensation methods, of castor, paraffin, bergamot, lavender, and lemon oil. For castor oil, ρ_u increases, ρ_v and ρ_h decrease, with decreasing λ, in contrast with dispersion in sols (A., 1937, I, 514). The spherical droplets of (ii) are smaller than in (i) with $d \sim 0{\cdot}1$—$0{\cdot}5$ μ. The small vals. of ρ_v and ρ_h, which are greater in (ii) than in (i), are due to depolarised secondary scattering.
I. McA.

Reciprocity theorem in colloid optics. (Oriented particles.) R. S. KRISHNAN (Proc. Indian Acad. Sci., 1938, **7**, A, 91—97; cf. A., 1937, I, 614; 1938, I, 247).—Measurements are recorded of the intensities of the scattering components and of the depolarisation factors ρ_u, ρ_v, and ρ_h, for white light transversely scattered from graphite sols subject to a magnetic field (0—8000 gauss) applied (i) parallel to the incident beam, (ii) parallel to the observed scattered beam, and (iii) perpendicular to the plane (P) of incident and observed beams. The marked changes are due to orientation (near saturation at the upper field limit) of the planes of the disc-like particles, parallel to the field. In confirmation of theory, only in (iii), where orientation is random in P, is the reciprocity relation $\rho_u = (1 + 1/\rho_h)/(1 + 1/\rho_v)$ satisfied for non-zero fields. The crystal analogy is discussed. I. McA.

Separation of emulsions [demulsification]. D. F. CHEESMAN and A. KING (Kolloid-Z., 1938, **83**, 33—37).—The rate of separation of the disperse phase in H_2O–C_5H_{11}·OH emulsions containing KCl or KI is in accord with Lederer's theory (A., 1935, 701) only when they are neutral or alkaline and of slight stability. Large divergences occur both with more stable systems and with the less stable emulsions containing acid. F. L. U.

Conditions of formation of hydrosols. I. N. N. ANDREEV (J. Gen. Chem. Russ., 1937, **7**, 2926—2929).—When org. compounds are dissolved in EtOH or $COMe_2$ and the solutions shaken with H_2O, stable emulsions are obtained only in the case of polar compounds (alcohols, acids, esters, $CHCl_3$, azoxy-compounds). R. T.

Stability of colloidal gold under hydrothermal conditions. C. FRONDEL (Econ. Geol., 1938, **33**, 1—20).—The stability of unprotected Au sols (from $HAuCl_4$ and H_2O_2) towards NaCl increases with rise in temp. and with increase in dilution of the sol. Unprotected sols containing no added electrolyte coagulate spontaneously between 150° and 250°. Colloidal SiO_2 protects colloidal Au both against NaCl and against spontaneous coagulation when the temp. is raised. Protection is accompanied by a reversal of charge of the sol. The protective action of SiO_2 against electrolyte increases with increasing dilution of the Au sol. Protected sols containing no added electrolyte are stable at 350°, but coagulate spontaneously at 410°. In the negative zone of stability protected sols are inert towards NaOH and sensitive to HCl; in the positive zone, the reverse is true. Unprotected sols behave similarly to negative protected sols, but the tolerance towards NaOH is less, and the sensitivity to HCl is greater. SiO_2 sols are colloidal at 25° and 100°, and probably up to 350°, in dilutions $\ll$ the solubilities reported by Hitchen (A., 1935, 292) and by Gruner (Econ. Geol., 1930, **25**, 700), who probably were dealing with a peptisation equilibrium which simulates a true solubility. The conditions of transportation and deposition of Au in acid and alkaline hydrothermal solutions are discussed. L. S. T.

Effect of X-radiation on the ζ-potential of colloidal graphite. (A) I. KEMP. (B) J. A. CROWTHER (Nature, 1938, **141**, 609).—(A) Since most living cells contain surface-active substances it is unlikely that the effect of X-rays on the surface charge of a colloid reported previously (A., 1937, I, 461, 614) can occur during the irradiation of cancerous animal tissue.

(B) A reply to the above. L. S. T.

Effect of ethyl alcohol on the viscosity of solutions of osogenic colloids. J. CLUZET and P. PONTHUS (Compt. rend. Soc. Biol., 1938, **127**, 1125—1127).—The addition of EtOH to agar solutions causes an increase in η due to dehydration of the agar micelle. H. G. R.

Effect of the concentration of ethyl alcohol on the stability of osogenic colloids. J. CLUZET and P. PONTHUS (Compt. rend. Soc. Biol., 1938, **127**, 1127—1129).—Up to 2% EtOH decreases the stability of agar solutions and produces partial flocculation, but an increase in the no. of dispersed granules, probably due to a suppression of the forces of hydration, occurs between 3 and 40%. Above 40% the no. of dispersed granules decreases. H. G. R.

Influence of surface-active anions and cations on silver halide sols and photographic emulsions. II. Absorption of surface-active alkylpyridinium cations by silver iodide. A. LOTTERMOSER and R. STEUDEL (Kolloid-Z., 1938, **83**, 37—51; cf. A., 1938, I, 261).—A method of analysing very dil. solutions of alkylpyridinium chlorides is described. The absorption of the dodecyl compound (I) by AgI sols was determined by analysis of the ultrafiltrate. At very low concns. of (I) complete absorption occurs up to a point where the total cross-sectional area of the absorbed (I) mols. is of the same order of magnitude as the surface area of the AgI particles. Beyond this point there is a slow linear rise, attributed to aggregation of (I) mols. The absorption is not represented by the usual adsorption isotherm, but consists in the formation of a complete unimol. layer by virtue of the capillary-active character of the (I) cations. The results are discussed in connexion with the behaviour of photographic emulsions which have been treated with surface-active ions. F. L. U.

Chemical properties of aërosols. R. E. LIESEGANG (Kolloid-Z., 1938, **83**, 217—221).—A review.

Investigation of periodic reactions by methods of physico-chemical analysis. XIII. F. M. SCHEMJAKIN and V. E. KRAUZE (J. Gen. Chem. Russ., 1938, **8**, 83—92).—The method of Ostwald (A., 1926, 1202) gives more exact results than does that of Morse (A., 1930, 1117) in the periodic pptn. of neutral-red with $K_2Cr_2O_7$, or of methylene-blue with $HgCl_2$ or $K_4Fe(CN)_6$, in H_2O. R. T.

Gel formed by grinding together ferrous and ferric salts. T. KATSURAI (Kolloid-Z., 1938, **83**, 37).—By grinding 1 part of $FeSO_4,7H_2O$ with 2 parts of $FeCl_3,6H_2O$ a gel is formed which is ferromagnetic and sol. in H_2O. F. L. U.

Distribution of solutes in silica gel. S. REDFERN and W. A. PATRICK (J. Physical Chem., 1938, **42**, 497—505) —The distribution of KCl, KBr, NaCl, NaBr, LiCl, $MgCl_2$, $CaCl_2$, $SrCl_2$, $BaCl_2$, and glucose

between SiO_2 gel (85%, 70%, and 50% H_2O) and H_2O has been studied at 25°. The molal concn. of solute in the gel is < that in the solution, and, assuming that part of the H_2O is bound by the SiO_2, it would appear that the amount of bound H_2O decreases with increasing SiO_2 content of the gel. The results cannot be explained satisfactorily on the basis of bound H_2O, adsorption, or the Donnan equilibrium. J. W. S.

Thixotropic behaviour of silica gels. H. FREUNDLICH and D. W. GILLINGS (J.C.S., 1938, 546).—SiO_2 sols yield thixotropic gels over the range p_H 8·5—9·5. This is also the range in which the sols can be coagulated by electrolytes (cf. A., 1926, 677). F. L. U.

Variations in viscosity of cellulose nitrate sols. II. A. A. MOROZOV and A. V. PAMFILOV (J. Gen. Chem. Russ., 1938, **8**, 175—181; cf. A., 1938, I, 138).—The progressive fall in the η of solutions of cellulose nitrate in PhMe–$COMe_2$ is ascribed to destruction of structure, and is associated with a gel → sol transformation. R. T.

Diffusion of hydrogen through regenerated cellulose and some cellulose derivatives. J. H. DE BOER and J. D. FAST (Rec. trav. chim., 1938, **57**, 317—332).—The permeabilities of celluloid, cellulose nitrate and triacetate (I) for H_2 are of the same order of magnitude and are 200—300 times the permeability of regenerated cellulose (II). The activation energies of the four types are of the same order of magnitude, the vals. for (I) and (II) being approx. equal. The greater permeability of (I) is probably due to diffusion taking place between the micelles and to the no. of paths available per cross-section being > in (II), rather than to a smaller combining energy between the main chains of micelles with a correspondingly smaller energy necessary for H_2 displacement. C. R. H.

Mechanism of deformation and fine structure of hydrous cellulose. IV. Micellar structure of hydrous cellulose fibres and processes involved in their deformation. P. H. HERMANS (Kolloid-Z., 1938, **83**, 71—83; cf. A., 1938, I, 139).—The data presented in the previous papers of the series are discussed and a comprehensive theory is put forward. F. L. U.

Micellar structure of cellulose. O. KRATKY and F. SCHOSZBERGER (Z. physikal. Chem., 1938, **B**, **39**, 145—154).—*X*-Ray work on ramie fibres, in which finely divided Au has been deposited, shows increases of 100—200% in the intensities of the reflexions occurring at the smallest glancing angle and of 100% for other reflected rays. The Au particles are deposited in the very small holes in the individual micelles as distinct from the large empty spaces of the micellar structure. After dissolving out the Au, all the intensities are approx. the same as before impregnation. T. H. G.

Influence of inorganic and organic substances on the viscosity of solutions of pectins. T. K. GAPONENKOV (J. Gen. Chem. Russ., 1937, **7**, 2906—2908).—The η of aq. araban is raised by addition of alkalis [KOH, $Ca(OH)_2$, $Ba(OH)_2$], as a result of salt formation, and is lowered by EtOH, $COMe_2$, or EtOH–Et_2O, owing to dehydration of the araban particles; KCl or sucrose has no effect. R. T.

Hydration and denaturation of proteins. D. M. WRINCH (Phil. Mag., 1938, [vii], **25**, 705—740).—The cyclol hypothesis of protein structure is developed with reference to hydration and denaturation of globular proteins. It is suggested that hydration consists of intra- and inter-mol. H_2O and also H_2O which is directly associated with the fabric of the mol., whilst denaturation, particularly of films, consists in breaking down the cyclol cage structures. Experimental results relating to the structures of films are compared with deductions based on this theory. T. H. G.

Electrokinetic aspects of surface chemistry. V. Electric mobility and titration curves of proteins and their relationship to the calculation of radius and mol. wt. L. S. MOYER and H. A. ABRAMSON (J. Biol. Chem., 1938, **123**, 391—403).—Electric mobility and titration curves for collodion particles in solutions of horse serum-albumin (I) and total globulin have been obtained over a wide p_H range and at const. ionic strength, and have been compared with earlier data for pseudoglobulin (II) (cf. A., 1938, I, 191). The mobilities of (I) and (II) are ∝ the bound H·. Semiempirical equations derived for the radii and mol. wt. of protein mols. give vals. in good agreement with vals. calc. from other data. C. R. H.

Negative non-amphoteric biocolloids as macromolecular electrolytes. I. Reciprocal hexol number and electrochemical equivalent weight. Charge density and stability of sols. H. G. B. DE JONG and P. H. TEUNISSEN (Kolloid-Beih., 1938, **47**, 254—320).—The substances investigated were Na arabate, pectinate, pectate, and oleate (" carboxyl colloids "), Na agar, Na carragheen, K chondroitinsulphate (" sulphate colloids "), and Na nucleate and phosphatides from soya bean and ovolecithin (" phosphate colloids "). Electrophoresis measurements in presence of salts with uni-, bi-, and ter-valent cations are said to show reversal of the sign of charge, and concns. corresponding with the iso-electric points are given. Similar experiments with hexol nitrate permit the calculation of the equiv. wt. of the respective substances. The equiv. wt. thus calc. is about 85% of that determined by chemical analysis, and the agreement supports the view that the behaviour of the substances towards electrolytes, and their negative charge and stability, are due to the no. and kind of ionising groups present. F. L. U.

Physico-chemical states of equilibrium. J. L. FINCK (J. Franklin Inst., 1938, **225**, 411—435).—Mathematical. The assumptions involved in the thermodynamic theory of equilibrium states are discussed. A theory is developed which postulates that all reactions require a catalyst and that individual atoms and mols. can be constrained by a catalyst to take and retain any associated or dissociated form. It is shown that a single gas phase is analogous thermodynamically to a liquid–vapour system, and the Clapeyron–Clausius equation is generalised, the

van't Hoff isochore being deduced as a special case. Explanations are given for endothermic and exothermic reactions and the crit. point. J. W. S.

Principles of the thermodynamics of solutions and the van't Hoff model. (Miss) J. Jaźwińska (Przemysł Chem., 1938, **22**, 49—66).—Mathematical. Expressions are derived for the external work of diffusion of one liquid in another, and for the heat of mixing of two liquids. Thermodynamic derivations of the equations of Duhem, Wrewsky, and Kirchhoff, and of Doroschevski's rule, are given. R. T.

Cyclic process differing from that of Carnot. The cyclic process considered qualitatively. A. K. Vlček (Chem. Obzor, 1937, **12**, 206—210). F. R.

Strength of picric acid. H. von Halban and M. Seiler (Helv. Chim. Acta, 1938, **21**, 385—392).—The thermodynamic dissociation const. of picric acid in H_2O at 20°, derived from photo-electric measurements, is 0·381. Data are also recorded for picric acid in aq. KCl, NaCl, HCl, and EtOH, respectively. E. S. H.

Effect of temperature on the dissociation of sulphuric acid. P. Koteswaram (Current Sci., 1938, **6**, 445—446).—Changes in the structure, intensity, and frequencies of the Raman lines 416, 558, 928, 1048, 1178 at 30° and 200° are recorded. The similarity between the effects produced by a rise in temp. and by dilution indicates that H_2SO_4 dissociates into H· and HSO_4' at higher temp. There is some evidence of the formation of SO_4'' ions at 200°. L. S. T.

Physicochemical properties of ascorbic acid.—See A., 1938, II, 217.

Heteropolar molecules. S. Kilpi (Z. physikal. Chem., 1938, **181**, 473—474).—An error in Kern's application of the Michaëlis equation for the degree of dissociation of acids is pointed out (cf. A., 1938, I, 192). The titration curve of the polyacrylic acids cannot be followed by stepwise neutralisation. H. J. E.

Sugar alcohols. X. Effect of certain sugar alcohols and their anhydrides on the dissociation of boric acid. F. K. Bell, C. J. Carr, W. E. Evans, and J. C. Krantz, jun. (J. Physical Chem., 1938, **42**, 507—513; cf. A., 1936, 289, 1463).—The electrometric curve of H_3BO_3, titrated with 0·1N-NaOH, has been studied in presence of styracitol (I), polygalitol (II), *l*-arabitol (III), β-*d*-mannoheptitol (IV), pinitol (V), and hydroxypyruvaldehyde (VI). The displacement by (IV) is $\geq$ that of mannitol and sorbitol, whilst the effects of (I), (II), and (V) are approx. equal. (VI) forms a complex which requires $>$ the theoretical amount of NaOH for neutralisation. This is attributed to enolisation. The effect of (III) is $<$ that of mannitol and sorbitol, and $\ll$ that of α-mannitan. The results with syrupy and α-mannitan differ quantitatively and evidence is given that they have different structures. The conductivities of 0·5M-H_3BO_3 containing the alcohols are recorded. J. W. S.

Rational unit for the p_H value. J. Gerstle (Trans. Electrochem. Soc., 1938, **73**, Preprint 28, 391—399).—A new unit of acidity, the "decihydron," represented by 10 log $(aH^·)_1/(aH^·)_2$ where $(aH^·)_1$ is the H-ion activity of the solution under examination and $(aH^·)_2$ that of some comparison standard, is suggested. J. W. C.

Base strengths and absorption spectra of *p*-methylacetophenone and *p*-bromoacetophenone. L. A. Flexser and L. P. Hammett (J. Amer. Chem. Soc., 1938, **60**, 885—886).—Base strengths have been calc. from measurements of the ultraviolet absorption of solutions of the compounds in H_2SO_4–H_2O. The effect of substituents on the free energy change for the basic ionisation of COPhMe is about 2·56 times that for the acid ionisation of BzOH. E. S. H.

Extent of dissociation of salts in water. VII. Conductivity of mixtures. C. W. Davies (J.C.S., 1938, 448—453; cf. A., 1938, I, 196).—Available data for the conductivities of aq. salt mixtures are discussed. In every recorded case the conductivity change on mixing two salt solutions, so far as it is not accounted for by mobility changes, is of the sign and magnitude predicted on the basis of the known dissociation consts. Deviations from additivity cannot, however, be taken as evidence of complete dissociation. F. L. U.

Slow hydrolysis of ferric chloride in dilute solution. I. Change in conductance, colour, and chloride-ion concentration. A. B. Lamb and A. G. Jacques (J. Amer. Chem. Soc., 1938, **60**, 967—981).—The results of conductometric, colorimetric, and electrometric investigations over a wide range of concn. and temp., with and without addition of acids, confirm the increased rate of hydrolysis with increasing dilution or rise of temp., the induction period in conc. solutions, and the retarding effect of HCl or HNO_3. H_2SO_4 exerts an initial acceleration due to adsorption of SO_4'' by the colloidal $Fe(OH)_3$, but the subsequent influence is retarding. The extent of the final conversion into $Fe(OH)_3$ and HCl has been calc. for a range of concns. and temp.; conversion is the more nearly complete the higher is the temp. and the lower the initial $[FeCl_3]$. The final state is a heterogeneous equilibrium, which adjusts itself slowly at low temp. The amount of adsorption of HCl and $FeCl_3$ by colloidal $Fe(OH)_3$ is slight. E. S. H.

Oxides of thiocarbamide.—See A., 1938, II, 176.

Application of the Raman effect to the study of complexes in solutions containing mercuric bromide and an alkali bromide. (Mlle.) M. L. Delwaulle, F. François, and J. Wiemann (Compt. rend., 1938, **206**, 1108—1110).—For vals. of the mol. ratio (R) of $HgBr_2$ to alkali bromide >1, new Raman frequencies of 179—183 and <38 cm.$^{-1}$ are observed in aq. or EtOH solution which are attributed to the presence of the $(HgBr_3)'$ complex. For $R < \frac{1}{2}$ frequencies of 167—171 and 42—46 cm.$^{-1}$ are observed, which are attributed to the $(HgBr_4)'$ complex. The $(HgBr_4)'$ ion is tetrahedral with the Hg at the

centre. In $(HgBr_3)'$ the Hg atom is at a corner of the tetrahedron. H. J. E.

Buffer intensities of milk and milk constituents. III. Buffer action of calcium citrate.—See A., 1938, III, 408.

Transition temperature of sodium sulphate heptahydrate. E. R. WASHBURN and W. J. CLEM (J. Amer. Chem. Soc., 1938, **60**, 754—757).—The transition point for $Na_2SO_4,7H_2O \rightleftharpoons Na_2SO_4$ is $23{\cdot}465 \pm 0{\cdot}004°$. This point is proposed as a secondary standard in calibrating thermometers. E. S. H.

Transition temperatures of lithium chloride hydrates. M. P. APPLEBEY and R. P. COOK (J.C.S., 1938, 547; cf. A., 1935, 35).—Transition temp. for $LiCl \rightleftharpoons LiCl,H_2O$, and $LiCl,H_2O \rightleftharpoons LiCl,2H_2O$ have been determined dilatometrically. The most probable vals. are $93{\cdot}55 \pm 0{\cdot}05°$ and $19{\cdot}1 \pm 0{\cdot}05°$, respectively. F. L. U.

Melting diagrams of binary mixtures of the halides of sulphur, phosphorus, arsenic, antimony, bismuth, tin, and aluminium. N. A. PUSHIN and J. MAKUC (Z. anorg. Chem., 1938, **237**, 177—182).—Equilibrium diagrams for the following systems are given: $AsBr_3$–PBr_3, $AlCl_3$–$AlBr_3$, $BiBr_3$–$AsBr_3$, $BiBr_3$–$SbBr_3$, $AsBr_3$–PBr_5, $SbBr_3$–PBr_3, $SbBr_3$–S_2Br_2, $SbBr_3$–$SnBr_4$, $SbBr_3$–Br, S_2Br_2–PBr_5, $SnBr_4$–$AlBr_3$, $SnBr_4$–S_2Br_2, $AlBr_3$–Br, $AlBr_3$–PBr_3, $SnBr_4$–PBr_3, $SnCl_4$–PCl_3, $AsBr_3$–Br, $AsBr_3$–S_2Br_2, $AlBr_3$–$AsBr_3$, $SnBr_4$–$AsBr_3$, and $BiBr_3$–$SnBr_4$. $AsBr_3$ and PBr_3 form a complete range of solid solutions, and $AlBr_3$ forms solid solutions with $AlCl_3$ up to 30 mol.-% of the latter. In other cases solid solutions are not formed. No compounds are formed in any of the systems. $BiBr_3$ and $SnBr_4$ form two liquid layers. F. J. G.

Affinity. LXXVIII. Nickel phosphides. W. BILTZ and M. HEIMBRECHT (Z. anorg. Chem., 1938, **237**, 132—144).—The system Ni–P has been studied by means of tensimeter curves and *X*-rays. The existence of NiP_3, NiP_2, and Ni_2P is confirmed and a new *phosphide* of composition approx. Ni_6P_5 is indicated. F. J. G.

Dissociation pressures of the hydrides and deuterides of rubidium and cæsium. A. BOROCCO (Compt. rend., 1938, **206**, 1117—1118; cf. A., 1937, I, 420).—Data are recorded for the range 190—330°. The dissociation pressures of the deuterides are approx. double those of the hydrides. H. J. E.

Thermal dissociation of manganese dioxide and barium manganate. Entropy and heat of formation of manganese oxide. A. F. KAPUSTINSKI and K. S. BAJUSCHKINA (J. Phys. Chem. Russ., 1938, **11**, 77—83).—For the O_2 pressure above MnO_2 the equation $\log p = -31{,}540/4{\cdot}573T + 8{\cdot}126$ (p in atm.) is found. For $BaMnO_4$ $\log p = -61{,}516/4{\cdot}573T + 15{\cdot}546$. The dissociation pressure of MnO_2 is not affected by admixture with $BaMnO_4$ but that of BaO_2 is increased in the same circumstances. J. J. B.

Reflexion and absorption of visible radiation in the system potassium chloride–cupric chloride. G. GLOCKER and R. E. DIETMEIER (J. Amer. Chem. Soc., 1938, **60**, 753—754).—Anhyd. $CuCl_2$ and its mixtures with KCl show a max. of reflexion at 6404 A. An absorption max. in the mixtures at 5387 A. is ascribed to $CuCl_3'$. E. S. H.

Mutual solubilities of hydrocarbons. II. F.-p. curves of dotriacontane (dicetyl) in dodecane, decane, octane, hexane, *cyclo*hexane, and benzene. W. F. SEYER (J. Amer. Chem. Soc., 1938, **60**, 827—830; cf. A., 1936, 1456).—F.-p. data are recorded. The curves are almost coincident for mixtures containing >40 mol.-% of dicetyl. E. S. H.

Liquid–vapour equilibria of binary systems of nitrotoluenes. E. LEVIN and I. SCHTERN (J. Appl. Chem. Russ., 1938, **11**, 426—441).—The fusion diagrams given by previous workers for the systems *o*- + *m*-, *o*- + *p*-, and *m*- + *p*-$C_6H_4Me{\cdot}NO_2$ are in the main confirmed; a 3 : 2 *compound*, m.p. 24·4°, is found in the first system. B.p. and vapour phase composition curves are given for the systems at 120 mm. pressure. Varying the pressure does not affect the results of fractional distillation of the mixtures. R. T.

Ternary system KF–HF–H_2O. I. TANANAEV (J. Appl. Chem. Russ., 1938, **11**, 214—222).—The solid phases at 0°, 20°, and 40° are KF,1, 2, 3, and 4HF, together with 2KF,5HF. R. T.

Complex of lead and lithium iodides. L. ROGER (Compt. rend., 1938, **206**, 1181—1183; cf. A., 1937, I, 412).—PbI_2, $LiI,3H_2O$, and $PbI_2,LiI,4H_2O$ (I), but not $PbI_2,2LiI,4H_2O$ (cf. A., 1899, ii, 222) occur as solid phases in the system PbI_2–LiI–H_2O at 0—60°; an equilibrium diagram is given. The region of stability of (I) becomes smaller at higher temp., and another solid phase containing less H_2O than (I) ultimately occurs. A. J. E. W.

Liquidus surface of the system sodium, lithium, and calcium nitrates. A. LEHRMAN and D. BRESLOW (J. Amer. Chem. Soc., 1938, **60**, 873—876).—Recorded m.p. are: $LiNO_3$ 251·4°, $NaNO_3$ 305·5°. The system has a ternary eutectic at 170·3°, with $NaNO_3$ 40, $LiNO_3$ 30·5, $Ca(NO_3)_2$ 29·5%. E. S. H.

Polytherms of the ternary system KH_2PO_4–$NH_4H_2PO_4$–H_2O from −4·45° to 40°. V. A. POLOSIN and R. K. OZOLIN (Kalii, 1937, No. 10, 31—34).—Data relating to the 0°, 10°, 20°, 25°, 30°, and 40° isotherms and the invariant points are recorded. KH_2PO_4 and $NH_4H_2PO_4$ form a continuous series of solid solutions. The binary systems KH_2PO_4–H_2O and $NH_4H_2PO_4$–H_2O have simple eutectics and do not form hydrates. D. G.

Ternary system selenium dioxide–barium selenite–water at 0°, 25°, and 50°. J. L. NEAL, jun., and C. R. MCCROSKY (J. Amer. Chem. Soc., 1938, **60**, 911—914).—At each temp. the stable, solid phases are H_2SeO_3, $BaSe_2O_5$, and $BaSeO_3$. The reported existence of $BaSeO_3,H_2O$ cannot be confirmed. E. S. H.

Intersection of nodes in diagrams of ternary systems. D. N. TARASENKOV and I. A. PAULSEN (J. Gen. Chem. Russ., 1938, **8**, 76—82).—The nodes

of the ternary liquid systems EtOH–H_2O–C_6H_6, –PhMe, or –*cyclo*hexane, AcOH–H_2O–C_6H_6 or –$CHCl_3$, and $COMe_2$–H_2O–$CHCl_3$ are shown, when produced, to intersect in a single point. R. T.

Three-component systems. I. Systems composed of sulphuric acid, water, and either zinc sulphate or magnesium sulphate. II. The system: zinc sulphate, magnesium sulphate, and water. N. K. JOSHI and S. C. DEVADATTA (Proc. Indian Acad. Sci., 1938, **7**, **A**, 130—138, 139—143).—I. Solubility data are recorded for 30° and 45°. At 30°, with increasing [H_2SO_4], the hepta-, hexa-, and mono-hydrates appear successively in the case of both salts; at 45° $ZnSO_4,7H_2O$ is not stable. There is no evidence of intermediate hydrates.

II. The system has been studied at 30° and 45°. No double salts are formed but solid solution formation is indicated. I. McA.

Influence of ammonium sulphate on the physical and chemical processes taking place during fusion of soda–lime–silica glass. M. A. BEZBORODOV and N. O. ABELTSCHUK (J. Appl. Chem. Russ., 1938, **11**, 234—252).—Dry $(NH_4)_2SO_4$ fuses, and simultaneously dissociates, at 250°, forming a film covering the particles of $CaCO_3$, Na_2CO_3, and SiO_2. It then reacts chiefly with Na_2CO_3 to yield Na_2SO_4, which, again, acts as a solvent for Na_2CO_3. In this way the surface of contact of the constituents of the mixture SiO_2–$CaCO_3$–Na_2CO_3 is greatly increased, so facilitating silicate formation at >300°. R. T.

Heat capacity of silver sulphide. A. F. KAPUSTINSKI and B. K. VESELOVSKI (J. Phys. Chem. Russ., 1938, **11**, 68—76).—The heat of transition of β- into γ-Ag_2S is 1050±20 g.-cal. per mol. The heat capacity of γ-Ag_2S between 179° and 570° is 22·0 g.-cal. per mol. J. J. B.

Heat capacities of nickel suboxide. Free energy of formation of nickel suboxide. A. F. KAPUSTINSKI and K. A. NOVOSELTZEV (J. Phys. Chem. Russ., 1938, **11**, 61—67).—For NiO $C_p = 14{\cdot}1 + 3{\cdot}1 \times 10^{-4}T - 4{\cdot}6 \times 10^{4}T^{-2}$ g.-cal. per mol. between 25° and 1123°. J. J. B.

Energy of isomerisation of normal pentane into tetramethylmethane. F. D. ROSSINI and J. W. KNOWLTON (J. Chem. Physics, 1938, **6**, 168).—At 25° and 1 atm. the heat of combustion of CMe_4 is $\Delta H = 840{\cdot}58 \pm 0{\cdot}23$ kg.-cal. per mol. Combining this with the recorded val. for the heat of combustion of *n*-C_5H_{12} yields for the heat of isomerisation −4·68± 0·30 kg.-cal. per mol. W. R. A.

Heats of combustion, refraction data, and the alkaline hydrolysis of ethyl β-vinylacrylate and the three pentinenoic acids. E. SCHJÅNBERG (Z. physikal. Chem., 1938, **181**, 430—440).—The strength of the C:C bond is calc., and is shown to depend on its position in the mol. relative to the CO_2H. The max. strength is observed in the α-β position, and the min. in the γ-δ position. The refraction and dispersion increments of the C:C bond are calc. and the constitutional influence is discussed. The temp. dependence (0—40°) of the alkaline hydrolysis of the esters has been studied. The rate of hydrolysis of the esters of Δ^{α}-pentinenoic acid is > that of the isomeric acids; this is attributed to a greater val. of the const. A in the equation $k = A.e^{-q/RT}$. H. J. E.

Heat content of various states of division of gold. R. FRICKE and F. R. MEYER (Z. physikal. Chem., 1938, **181**, 409—429).—The heat of dissolution in aq. ICl_3 at 40° of unprotected colloidal Au, and of Au protected by gelatin, has been measured. The Au was pptd. by H_2O_2 in alkaline solution. The heat content of protected Au (particle size 60—80 A., measured by *X*-rays and by the Hahn emanation method) is 1·1 kg.-cal. per g.-atom > that of massive Au. The increase in heat content is inversely ∝ the particle size, and is very small for particle sizes >150 A. The increase is due to increased surface and not to lattice defects or lattice strain. The calc. surface energy (670 ergs per cm.^{2}) is < that found by other methods, the difference being attributed to partial aggregation. H. J. E.

Direct-current conductances of potassium chloride solutions. L. V. ANDREWS and W. E. MARTIN (J. Amer. Chem. Soc., 1938, **60**, 871—873).—Procedure is described and results are recorded for 0·01—0·0005N-KCl at 25°. E. S. H.

Amalgam activities and standard electrode potentials. I. Tin. M. M. HARING and J. C. WHITE (Trans. Electrochem. Soc., 1938, **73**, Preprint 27, 379—389).—For the electrode $Sn^{\cdot\cdot}|Sn$ at 25°, $E_h = -0{\cdot}1406 \pm 0{\cdot}0002$ v. Sn is 1 mv. more negative than saturated Hg–Sn amalgam. The activity at 25° of Sn in amalgams of increasing concn. up to saturation, and the solubility of Sn in Hg, have been determined. J. W. C.

Potentials of platinum electrodes in photographic developers. A. E. CAMERON (J. Physical Chem., 1938, **42**, 521—530).—The potentials of Pt electrodes in elon and quinol developer solutions vary with the [O_2] as well as the concn. of reducing agent. The principal effect of Na_2SO_3 is to destroy the reversible oxidation-reduction system which might mask the O_2 electrode potential. J. W. S.

Potentials developed by certain metals in ethereal solutions of magnesium iodide. N. V. KONDIREV and V. I. JURIEV (J. Gen. Chem. Russ., 1937, **7**, 2903—2905).—The potentials obtained when the following electrodes are combined with a Pt electrode in 0·117—0·125N-MgI_2 in Et_2O increase in the order Ni, Sb, Sn, Al, Hg, Zn, Ag, Cu, Pb, Cd, Mg, Na; the potential is zero with Au. In certain cases the potentials rise with increasing [MgI_2]. R. T.

Equations for the thermodynamic calculation of the e.m.f. of gas cells. O. SCARPA (Atti R. Accad. Lincei, 1938, [vi], **27**, 3—5).—The e.m.f. at const. vol. is derived from the Gibbs–Helmholtz equation. O. J. W.

Thermodynamics of the lead accumulator. B. KABANOV (J. Phys. Chem. Russ., 1938, **11**, 155—157).—The theory of Harned and Hamer (A., 1935, 305) is supported by the actual behaviour of the cell. J. J. B.

Volta effect in solid metallic alloys. I. O. SCARPA (Atti R. Accad. Lincei, 1938, [vi], **27**, 6—11).

—For Cu–Ni alloys the Volta effect with respect to pure Cu increases almost linearly with the % of Ni in the alloy. In the Sn–Zn system small amounts of Zn are sufficient to destroy almost completely the Volta effect of pure Sn with respect to Zn. O. J. W.

Electrification by bubbling. G. Lovera and A. Pochettino (Nuovo Cim., 1937, **14**, 393—410).—Experiments on the electrification of N_2 produced by bubbling it through solutions of quinine H sulphate, methylene-blue, uranine, and gelatin are described. The results are discussed in relation to Lenard's theory (cf. A., 1915, ii, 507). O. J. W.

Decomposition potentials of molten potassium and sodium fluorides. V. S. Moltschanov (Legk. Met., 1935, **4**, No. 5, 28—31).—The following vals. are recorded for a special form of graphite cell: KF, 900°, 2·13 v.; 940° 2·00 v.; 980° 1·70 v.; NaF, 860° 2·95 v.; 920°, 2·80 v.; 968°, 2·63 v., and 1022°, 2·45 v. Ch. Abs. (*e*)

Non-equilibrium oxidation-reduction potential. N. I. Nekrassov (J. Phys. Chem. Russ., 1938, **11**, 84—98).—In the absence of equilibrium or when the equilibrium establishes itself very slowly, the potential is determined by the concns. and by the rates of formation of the oxidising and reducing agents in the solution. A change of $[O_2]$ in the gas may affect a non-equilibrium potential more strongly than equilibrium potentials. J. J. B.

Reducing effect of Röntgen rays on reduction-oxidation potential of indicator dyes. W. Seitz (Strahlenther., 1938, **61**, 140—154).—Since *X*-rays in their passage through materials liberate electrons, there must be an increase in the reduction potential of the material. The response of reduction–oxidation potential indicator dyes at p_H 7 in dil. solution to *X*-rays was investigated under anaërobic conditions with controls. It was found possible to reduce indicators ranging from 2 : 6-dichlorphenol-indophenol (E_h +217 mv.) to phenosafranine (E_h −525 mv.) to the leuco-base, the time required being $\propto$ the quantity of dye present. The reaction is reversible. S. H.

Overvoltage and the mechanism of electrolytic evolution of hydrogen. K. Wirtz (Z. Elektrochem., 1938, **44**, 303—326).—A review.

Electrode polarisation in the course of cathodic deposition of heavy metals from fused electrolytes. S. Karpatschev and S. Rempel (J. Phys. Chem. Russ., 1938, **11**, 144—148).—The cathode potentials of Cd in $CdCl_2$, Pb in $PbCl_2$, and Tl in TlCl (all molten) are independent of the c.d. between 0 and 300 amp. per sq. dm. An explanation is advanced for the absence of polarisation. J. J. B.

Activation of passive chromium. W. J. Müller (Z. physikal. Chem., 1938, **181**, 469—472).—Polemical against E. Müller (cf. A., 1938, I, 144). H. J. E.

Dependence of the height of the polarographic wave on the concentration of the ion being determined. E. N. Varasova (J. Gen. Chem. Russ., 1938, **8**, 93—96).—Polemical, against Pavlov (A., 1938, I, 143). R. T.

Does the decomposition of chloride monoxide begin as a homogeneous bimolecular reaction? M. Bodenstein and Z. Szabó (Z. physikal. Chem., 1938, **B**, **39**, 44—49).—The decomp. of Cl_2O begins with almost const. velocity before rising to a max., but the actual val. of this velocity depends on the area and nature of the surface in contact with it. Hence the initiation of the reaction cannot be homogeneous, as would be inferred from other characteristics of the change. J. W. S.

Oxidation of methane [and other hydrocarbons].—See A., 1938, II, 167.

Kinetics of thermal polymerisation of butadiene. S. V. Lebedev, and M. A. Chochlovkin, L. I. Kuibina, and A. P. Begetova (Sintet. Kautschuk, 1936, No. 1, 2—4).—The thermal polymerisation of liquid butadiene at 110°, 120°, 130°, 150°, 175°, and 200° was studied. The energy of activation was 13,000 g.-cal. in the liquid phase and 25,000 g.-cal. in the gaseous phase. O_2 accelerated the thermal polymerisation. The liquid-phase reaction was homogeneous. Ch. Abs. (*e*)

Decomposition of gaseous ethyl bromide. P. Fugassi and F. Daniels (J. Amer. Chem. Soc., 1938, **60**, 771—778).—The rate of decomp. at 395° and the nature of the products have been determined, using special precautions to eliminate traces of O_2. Decomp. is of the first order, and the consts. agree with published data (A., 1932, 815, 1002; 1933, 469). The influence of increased surface, and of H_2, N_2, Br, and Hg has been investigated. The mechanism discussed is based on primary decomp. into free Et radicals and Br atoms without involving a chain reaction. E. S. H.

Unimolecular decomposition of gaseous chloropicrin. E. W. R. Steacie and W. McF. Smith (J. Chem. Physics, 1938, **6**, 145—149).—The decomp. of gaseous $CCl_3{\cdot}NO_2$ has been investigated from 138° to 170° at pressures from 6 to 20 cm. The reaction is homogeneous and unimol. and the rate coeff. is $k = 4{\cdot}90 \times 10^{15}e^{-37670/RT}$ sec.$^{-1}$ $CCl_3{\cdot}NO_2$ gives initially $COCl_2$ and NOCl; the NOCl gives $NO + 0{\cdot}5Cl_2$. In addition NO and Cl_2 are formed by other means, which are qualitatively discussed. W. R. A.

Rapid exchange between deuteroammonia and hydrazine. P. C. Cross and P. A. Leighton (J. Amer. Chem. Soc., 1938, **60**, 981—982).—Exchange between ND_3 and N_2H_4 occurs in a few sec. at room temp., and evidence of exchange is shown at −70°. The mechanism is discussed. E. S. H.

Exchange of hydrogen atoms between nitrophenols and water. I. Exchange reaction and hydrogen linkage. M. Koizumi and T. Titani (Bull. Chem. Soc. Japan, 1938, **13**, 318—328).—Very rapid exchange occurs between the hydroxylic H atoms of *o*-, *m*-, and *p*-$OH{\cdot}C_6H_4{\cdot}NO_2$ and H_2O at 100° in alkaline solution. This is followed by exchange of 2 nuclear H of the *o*- and *p*- and 3 of the *m*-compound. The velocities of the nuclear exchange with *m*- and *p*- are nearly equal, and $\gg$ that with *o*-$OH{\cdot}C_6H_4{\cdot}NO_2$. The difference in the no. of exchangeable nuclear H is accounted for by the enhance-

ment and depression of reactivity of H situated *o*- and *p*- to the OH and NO_2 groups, respectively. The relatively small velocity shown by the *o*-compound is attributed to chelation. F. L. U.

Rate of hydrolysis of enol ethers. A. SKRABAL and R. SKRABAL (Z. physikal. Chem., 1938, **181**, 449—468).—Dilatometric and analytical measurements of the rate of acid hydrolysis at 25° of divinyl ether (I), 2 : 2-dimethylfuran, furan, $(CH_2)_2O$, and dioxan are recorded. Vals. of the acid hydrolysis const. of 41 ethers are tabulated. The relative amounts of acid- and alkali-catalysed hydrolysis and of uncatalysed hydrolysis are discussed. The presence of free partial valencies increases the acid hydrolysis const. Owing to this factor the const. for vinyl Et ether is > that for (I). The presence of double bonds and of rings in the mol. also tends to raise the const. The temp.-dependence of the hydrolysis const. is discussed. H. J. E.

Effect of groups on reaction rate. Reaction of αβ-dibromides with sodium iodide.—See A., 1938, II, 214.

Dehydration products of lactic acid.—See A., 1938, II, 169.

Kinetics of the formation of the Grignard reagent.—See A., 1938, II, 224.

Corrosion of rotating discs. II. A. URMÁNCZY (Z. anorg. Chem., 1928, **237**, 183—186).—The velocity of dissolution of a rotating disc of $Na_2S_2O_3$ in 73% EtOH increases linearly with the square root of the speed of rotation. At high speeds the disc develops markings resembling those formed on Ag discs rotated in HNO_3 (A., 1938, I, 257). They are caused by the expulsion of air bubbles which increase the rate of dissolution by disturbing the diffusion layer. F. J. G.

Determination of kinetics of dissolution of metals.—See B., 1938, 526.

Combustion and detonation of solid explosives.—See B., 1938, 592.

Shock wave and explosion products from detonating solid explosives.—See B., 1938, 593.

Impulse and conservation causality in nature. A. MITTASCH (Naturwiss., 1938, **26**, 177—183). A. J. M.

Catalysis and the theory of multiplets. A. A. BALANDIN (Uspech. Chim., 1935, **4**, 1004—1057).—A discussion. CH. ABS. (*e*)

Catalytic toxicity and chemical structure. III. Influence of various factors on the toxicity of sulphur compounds. E. B. MAXTED and H. C. EVANS (J.C.S., 1938, 455—458).—By restricting mobility, the addition of a second terminal S atom to a hydrocarbon chain of given length decreases the toxicity per g.-mol.; *e.g.*, $SH\cdot[CH_2]_3\cdot SH$ is less toxic than Pr^nSH or Bu^nSH. On the other hand, if the two S are adjacent, little change in toxicity is observed; *e.g.*, Et_2S_2 and Et_2S have approx. equal toxicity. The introduction of a branched chain or a double bond has only a slight effect. The toxic effects of compounds containing a hydrocarbon ring in place of a chain and of substituted thiocarbamides have also been investigated. C. R. H.

Reactivity of formaldehyde in presence of various bases. A. KUZIN (J. Gen. Chem. Russ., 1937, **7**, 2954—2963).—Reduction of Cu^{II} by CH_2O in presence of $Ca(OH)_2$ is > with NaOH. The velocity of the reaction $2CH_2O \rightarrow MeOH + HCO_2H$ is greater in presence of 2N-NaOH than of 2N-$Ca(OH)_2$, for 4—20%, but not 40%, CH_2O. The reaction $CH_2O + MOH \rightarrow HCO_2M + H_2$, in presence of $CuSO_4$ or Cu_2O, is greater when M = 0·5Ca than when M = Na; this is due to the more rapid formation of Cu, which catalyses the reaction, in the former case. In the system CH_2O–H_2O–alkali–Cu the reaction proceeds at the same rate with $Ca(OH)_2$ as with NaOH. It is supposed that CH_2O reacts with NaOH to yield $OH\cdot CH_2\cdot ONa$, dissociating into $OH\cdot CH_2\cdot O'$ and $Na^{\cdot}$, whilst with $Ca(OH)_2$ the reaction is $OH\cdot CH_2\cdot O\cdot CaOH \rightarrow OH\cdot CH\dot{:} + Ca(OH)_2$. R. T.

Influence of neutral salts on the inversion of sucrose. J. N. PEARCE and M. E. THOMAS (J. Physical Chem., 1938, **42**, 455—467).—The inversion of sucrose by HCl at 25° and 35° is accelerated by the presence of neutral salts, the effects of which are in the order $Al(NO_3)_3 > BaCl_2 > LiCl > NaCl > KCl$. The temp. coeff. of the reaction and hence its heat of activation is almost independent of the nature of the added salt and its concn. The results are explained on the theory that the sucrose mols. are hydrated through addition of H_2O to tetrahedral O atoms, the accelerating effect of the salt on the inversion being attributed to decrease in the thickness of the envelope of H_2O mols. round the reactants, owing to ionic hydration. The mechanism of the reaction is considered to comprise complex formation between the $H_3O^{\cdot}$ ion and the sucrose, the rate of decomp. of the complex determining the rate of reaction. J. W. S.

Inhibition in the inversion of sucrose. E. BAUR and H. PREIS (Helv. Chim. Acta, 1938, **21**, 437—441).—The reaction at 50° in 0·001N-H_2SO_4 is retarded by the addition of 0·001—0·01N-K_2SO_4, -$MnSO_4$, or -$CoSO_4$. The degree of inhibition is discussed with reference to $H^{\cdot}$ activity. E. S. H.

Inhibition of peroxidase action on guaiacum resin. E. BAUR (Helv. Chim. Acta, 1938, **21**, 441—445).—The influence of small amounts of $Co^{\cdot\cdot}$, urethane, veronal, cysteine, and barbituric acid on the rate of reaction has been determined. E. S. H.

Effect of sodium glycocholate on the saponification of glycerides by pancreatic extract.—See A., 1938, III, 529.

Rôle of the surface in processes of oxidation of aqueous sulphur dioxide by oxygen and ozone. L. I. KASCHTANOV and O. N. OLESCHTSCHUK (J. Gen. Chem. Russ., 1938, **8**, 182—187).—The velocity of oxidation of SO_2 in H_2O by O_2 or O_3 is twice as great at the surface as in the bulk of the solution; the surface reaction only is inhibited by PhOH. With low $[O_2]$ or $[O_3]$ in the gaseous phase the velocity of the reaction $\propto$ rate of diffusion of O_2 or O_3 to the active surface. R. T.

Poisoning of catalysts from the point of view of specificity of active centres. VI. Temperature-dependence of the relative life of molecules of water and ethyl alcohol on a copper catalyst. A. C. BORK (J. Phys. Chem. Russ., 1938, **11**, 109—111).—The relative life of H_2O on a Cu catalyst is independent of temp. between 240° and 267°. J. J. B.

Solvent factor in catalytic hydrogenation. E. B. MAXTED and V. STONE (J.C.S., 1938, 454—455).—The velocity of hydrogenation of $CHMe{:}CH{\cdot}CO_2H$ in EtOH, Et_2O, EtOAc, AcOH, *cyclo*hexane, and $CHCl_3$ appears to show no simple relation to the η or solvent power for H_2 of the solution, even if the partial pressure of H_2 is corr. for that due to the v.p. of the solvent. C. R. H.

Oxidation of litharge to minium. K. E. KRAUZE and O. K. KRAUZE (J. Appl. Chem. Russ., 1938, **11**, 403—408).—The reaction of oxidation of rhombic PbO to Pb_3O_4 is accelerated by addition of PbO_2; this effect is not observed in the oxidation of tetragonal PbO. Addition of tetragonal PbO to rhombic PbO has little effect on the oxidation of the latter. R. T.

Catalytic oxidation of ammonia on platinum at low pressures. W. KRAUSS (Z. physikal. Chem., 1938, **B**, **39**, 83—100).—NH_2OH and HNO_2 are the principal products, no N_2O or NO appearing. HNO_2 is formed in the gas space as well as on the surface of the Pt. NH is not the first product of the reaction since NH_2OH is not first formed on the walls of the vessel. T. H. G.

[Catalytic oxidation of ammonia.] L. ANDRUSSOV (Ber., 1938, **71**, [*B*], 776—778; cf. A., 1935, 1329).—A reply to Adadurov (A., 1937, I, 90). In spite of the thermal instability of NH_3 and CH_4 it is unnecessary to assume the intermediate formation of C, N, and H in the synthesis of HCN since the duration of reaction is almost immeasurably small. The postulated intermediate formation of NOH is upheld. H. W.

Velocity of hydrogenation of aromatic hydrocarbons. I. A. V. LOZOVOI and M. K. DJAKOVA (J. Gen. Chem. Russ., 1937, **7**, 2964—2977).—The reactions of hydrogenation of PhMe, *o*-, *m*-, and *p*-xylene, durene, *s*-$C_6H_3Me_3$, C_6HMe_5, PhEt, $PhPr^{\alpha}$, and *p*-$C_6H_4MePr^{\beta}$ (Ni–Al_2O_3 catalyst) proceed at const. velocity at 75—230°. At <110° the velocity of hydrogenation of PhMe is independent of the pressure, whilst at 190—200° it is $\propto$ pressure, over the range 20—140 atm. R. T.

Velocity of hydrogenation of aromatic hydrocarbons. II. Velocity of reaction and structure of hydrocarbons. M. K. DJAKOVA and A. V. LOZOVOI (J. Gen. Chem. Russ., 1938, **8**, 105—115).—The velocity v of hydrogenation of C_6H_6 homologues at a Ni–Al_2O_3 catalyst (15—230°/35—200 atm.) is expressed by $v = v_0/2^n$, where n is the velocity for C_6H_6. For xylenes, v falls in the order *p*- > *o*- > *m*-xylene. The same val. of v is obtained for PhMe, PhEt, and $PhPr^{\alpha}$, but v for $PhPr^{\alpha}$ is > for $PhPr^{\beta}$. R. T.

Regeneration of copper–nickel catalyst [from hardening of fats].—See B., 1938, 543.

Effect of a high-tension electrical discharge on contact catalytic reactions. III. Hydrogenation of soya-bean oil.—See B., 1938, 544.

Catalytic dehydrogenation of *cyclo*hexane in presence of oxides of chromium and vanadium.—See A., 1938, II, 224.

Rôle of catalysis in textile chemistry.—See B., 1938, 505.

Electrodeposition of manganese from aqueous solutions.—See B., 1938, 535.

Alkaline [copper] plating baths containing organic amines.—See B., 1938, 534.

Rochelle salt–copper cyanide plating bath.—See B., 1938, 534.

Electrolytic manufacture of white lead.—See B., 1938, 551.

Enrichment of deuterium oxide by electro-osmosis. S. V. THYSSEN (Naturwiss., 1938, **26**, 198).—Since the dielectric const. of D_2O (80·5) is < that of H_2O (82), and the viscosity of D_2O is > that of H_2O, D_2O must pass more slowly than H_2O through a diaphragm by electro-osmosis. An enrichment of D_2O in H_2O has been effected by this method. A. J. M.

Activation process in reactions in electric discharges. II. N. I. KOBOSEV, S. S. VASSILIEV, and E. N. EREMIN (J. Phys. Chem. Russ., 1938, **11**, 45—60; cf. A., 1938, I, 205).—Oxidation of N_2 is discussed. The electric energy supplied to the discharge apparatus is chiefly spent in (*a*) heating the electrodes, (*b*) light emission by excited mols., (*c*) ineffective excitation of O_2, and in (*d*) deactivation of active N_2 mols.; the remaining energy (*e*) is used for NO synthesis. The energy loss (*a*) explains the increase of the yield of NO per erg supplied with increasing distance between the electrodes. The loss (*c*) is partly responsible for the dependence of the NO yield on the ratio $[O_2] : [N_2]$, the yield increasing with that ratio at high c.d. and high pressures and decreasing with it at low c.d. and low pressures. Calculation of the energy (*e*) shows that the activation energy has a normal val.; hence the active mols. in the discharge are of the same kind as those in thermal reactions. J. J. B.

Chemical effect of electrical discharge in gaseous hydrocarbons. IX. Condensation of ethane, propane, butane, and propylene as a function of time, and comparison of rates of condensation of lower members of the paraffin, olefine, and acetylene series. S. C. LIND and G. R. SCHULTZE (J. Physical Chem., 1938, **42**, 547—558; cf. A., 1931, 60, 1249).—Each gas shows a relatively long induction period but reaction occurs more readily with larger mols. and with unsaturated mols. The product of mol. ionisation and chemical yield under α-radiation is considered to be the controlling factor in electrical decomp. and leads to vals. approx. in accord with experiment. J. W. S.

Chemical action of electric discharges. XV. Production of ammonia by the electric arc at different frequencies. E. BRINER and J. DESBAILLETS (Helv. Chim. Acta, 1938, **21**, 478—485; cf. A., 1938, I, 150).—The best yield of NH_3 is obtained at reduced pressure, with the ratio $N_2 : 3H_2$, using Pt or Cu electrodes, and at high frequency. A yield of 25 g. of NH_3 per kw.-hr. is reported. E. S. H.

Description in terms of atomic physics of the action of light on photographic emulsions. N. F. MOTT (Phot. J., 1938, **78**, 286—292; cf. A., 1938, I, 260).—From experiments on electrolytic conductivity and photoconductivity, considered in relation to the quantum and other modern theories, it is argued that electrons released on absorption of light will wander until trapped by Ag or Ag_2S specks, the conduction levels of which are lower than those of AgBr; such centres are then negatively charged, and will discharge by attracting to themselves Ag ions which have wandered to interstitial positions in the AgBr lattice. Solarisation is considered as recombination of excess of halogen with latent image Ag. Temp. effects are discussed, especially in relation to reciprocity failure (cf. Webb, A., 1937, I, 254). The crit. exposure necessary for developability of a grain is regarded as a crit. electron density, which is dependent on the equilibrium of the tendency of a speck to collect electrons and the tendency to lose electrons owing to thermal agitation. J. L.

Solarisation and development. A. P. H. TRIVELLI (Z. wiss. Phot., 1938, **37**, 98).—Arens' discovery (A., 1934, 1184) that solarisation effects disappear with prolonged development was anticipated by Trivelli in work recorded by Wilsey and Pritchard (cf. B., 1927, 157), who confirmed the results for *X*-rays also. J. L.

Theory of photodichroism. S. NIKITINE (Compt. rend., 1938, **206**, 1219—1222; cf. A., 1937, I, 317). A. J. E. W.

Mechanism of the photodecomposition of methyl and ethyl iodides. W. WEST and L. SCHLESSINGER (J. Amer. Chem. Soc., 1938, **60**, 961—966).—The gaseous decomp. products of MeI vapour at λ 2537 A., 25°, and 300 mm. are chiefly CH_4 with small amounts of C_2H_6 and C_2H_4; about 33% is converted into CH_2I_2. In presence of Ag foil the rate of decomp. is greatly increased, the main product is C_2H_6 with some CH_4 and C_2H_4, and all the I appears as AgI. EtI at λ 2537 A., 25°, and 100 mm. yields C_2H_6 and C_2H_4, and at λ 2026 A. small amounts of CH_4 and H_2 in addition; Ag foil increases the rate of reaction but has little influence on the nature of the products. In presence of inert gas up to 40 atm. the photolysis of EtI has an I yield increasing approx. linearly with the *d* of inert gas to vals. approaching 33% of the yield in inert liquid solvents. A mechanism of reaction is proposed. E. S. H.

Photochemical oxidation of methylene iodide; production of iodic anhydride. G. EMSCHWILLER (Compt. rend., 1938, **206**, 746—748; cf. A., 1935, 48; 1936, 572).—In a closed system, I_2O_5 is formed during irradiation of CH_2I_2–O_2 mixtures, afterwards reacting slowly with CH_2O formed in the reaction; this change is accelerated by light or the presence of HCO_2H. I_2O_5 is apparently not formed after all the CH_2I_2 has decomposed, although the photo-oxidation of CH_2O or HCO_2H in presence of I also gives I_2O_5 in small quantity. In a streaming system the amounts of I_2O_5 and HCO_2H formed are much less, suggesting a relation between the production of I_2O_5 and the oxidation of CH_2O. If the reaction products are removed by an O_2 stream from the illuminated zone, the reaction is much slower, showing that the products catalyse the reaction. The possibility of a peroxide mechanism is discussed. A. J. E. W.

Photolysis of acetone in the presence of hydrogen. H. S. TAYLOR and C. ROSENBLUM (J. Chem. Physics, 1938, **6**, 119—123).—The photodecomp. of $COMe_2$ in the presence and absence of H_2 by light of λ 2500 A. has been studied between 70° and 300°. When H_2 is absent $COMe_2$ up to 160° yields practically no CH_4, and C_2H_6 predominates. With H_2 there is no CH_4 at 70° but an appreciable amount at 160°. Under both conditions the yield of CH_4 increases rapidly with temp. C_2H_6 formation is either a wall reaction with zero activation energy or a bimol. association process with small activation energy. The activation energy of the reaction $CH_3 + H_2 = CH_4 + H$ is 11 ± 2 kg.-cal. Suitable reaction mechanisms are discussed. W. R. A.

Mechanism of decomposition. III. Vapour-phase photolysis of propionic acid. H. HENKIN and M. BURTON (J. Amer. Chem. Soc., 1938, **60**, 831—836; cf. A., 1936, 1349).—The photolysis of $EtCO_2H$ or AcOH may proceed either by a rupture involving the formation of at. H or by a rearrangement mechanism yielding ultimate mols. in the primary act. Per einstein absorbed, rupture is at least 2·3 times as frequent for $EtCO_2H$ as for AcOH; in both cases rearrangement mechanisms are possibly predominant. The energy of activation of the reaction by which H atoms disappear in AcOH has been re-determined as 8·5—9·9 kg.-cal.; that for the similar reaction in $EtCO_2H$ is about 0·8 kg.-cal. less, which may indicate a weakening in the C–C linking at the CO_2H radical with increase in length of the C chain. Alkyl or RCO radicals do not appear to be formed during photolysis. E. S. H.

Photochemical reactions of cellulose.—See B., 1938, 496.

Exchange of hydrogen atoms between water and pyrrole, indole, and their methyl derivatives. IV. Exchange of hydrogen atoms between indole and water. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 307—318; cf. A., 1938, I, 255; II, 244).—Exchange occurs in three stages, viz., (1) of the imino-H between p_H 7 and 2·5, (2) of the β-H at p_H 2·5—0·5, and (3) of the α-H in more acid solutions. The exchanges were followed by using aq. D_2O. Polymerisation of the indole occurs simultaneously with the H exchange, especially at higher acid concns., but always much more slowly than the exchange reactions. The latter are explained on the assumption of a tautomeric change. F. L. U.

Sodium polyphosphates. K. R. ANDRESS and K. WÜST (Z. anorg. Chem., 1938, **237**, 113—131).—The formation of Na polyphosphates by fusing $NaPO_3$ and $Na_4P_2O_7$ together has been studied. Of the compounds described in the older lit. only $Na_5P_3O_{10}$ exists. The aq. solutions of the two substances having this formula are identical. F. J. G.

Dehydration of acid sodium pyrophosphate. A. BOULLÉ (Compt. rend., 1938, **206**, 915—917).—When heated at $<300°$ in air or in a vac., $Na_2H_2P_2O_7$ gives $>80\%$ of Na trimetaphosphate (*A*), sol. in H_2O, with two insol. metaphosphates *B* and *D*; these give *A* at 550° and 485°, respectively. Dehydration in H_2O vapour at $>300°$ gives pure *B*. *A* is converted into a glassy metaphosphate, *C*, at 640°. A. J. E. W.

Calcium alkali phosphates. H. Calcium potassium phosphates. M. A. BREDIG and E. KANERT (Z. anorg. Chem., 1938, **237**, 49—78).—By heating Ca phosphates with K_2CO_3, KNO_3, or K_2HPO_4 the following *compounds* have been obtained: $CaKPO_4$ (I), $Ca_8K_2(PO_4)_6$ (II), $CaK_2P_2O_7$. (I) exists in two modifications with a transition temp. at 705°. They are denoted as α- and β-K rhenanite. (II) has the apatite structure. The equilibrium diagram for the ternary system CaO–K_2O–P_2O_5 is discussed in the light of these results. When the reactants are heated in a CO_2 atm. α-(I) takes up $CaCO_3$ and K_2CO_3 without change of structure, and does not then change over to the β-form on tempering at 600°. A *di-calcium carbonate-apatite*, $Ca_{11}(PO_4)_6(CO_3)_2$, is also formed. F. J. G.

Hydration of the aluminates, silicates, and double salts of calcium. J. LEFOL (Compt. rend. XVII Cong. Chim. Ind., 1937, 562—571).—Experiments on progressive dehydration give evidence that hydrated $4CaO,Al_2O_3$ contains 6 mols. of H_2O chemically bound, and compounds containing 6—12 mols. of H_2O are zeolitic in character. The following formulæ indicate similar conclusions in regard to other compounds: $2CaO,Al_2O_3,5H_2O$ + 0—$4H_2O$; $3CaO,Al_2O_3,3CaSO_4,6{\cdot}5H_2O$ + 1·5—$23{\cdot}5H_2O$; $3CaO,Al_2O_3,CaCl_2,6H_2O$ + 0—$4H_2O$; CaO,SiO_2,H_2O + 1—nH_2O. G. H. C.

Reactions between calcium oxide and chromic oxide during heating. I. F. I. VASENIN (Trans. Union Res. Inst. Cements, U.R.S.S., 1937, No. 17, 40—51).—Homogeneous crystal structures, *i.e.*, definite chemical compounds, are produced when 1 : 1 and 3 : 1 mixtures of CaO and Cr_2O_3 are heated above 1020° in air. The 1 : 1 mixture gives well-defined green prismatic crystals of CaO,Cr_2O_3, whilst the 3 : 1 mixture gives anisotropic irregular crystals of Ca_3 oxychromite of varying composition. Chromates are formed at 600—800°, but are reduced to chromites above 1020°. D. G.

Calcium cyanide, and especially the reaction calcium cyanide ⇌ calcium cyanamide. G. PETERSEN and H. H. FRANCK (Z. anorg. Chem., 1938, **237**, 1—37).—When $Ca(CN)_2$ is exposed to atm. H_2O a *basic cyanide* $Ca(OH)\cdot CN$ is formed. It forms mixed crystals with $Ca(CN)_2$, and it is the end-product of the action of HCN on $Ca(OH)_2$. When $Ca(OH)\cdot CN$ is strongly heated in vac. it decomposes to CaO and HCN, but when heated in presence of CaC_2 at 450° some $Ca(CN)_2$ is formed. When heated above 450° under its own dissociation pressure it forms $CaCN_2$, CaO, and C. The m.p. of $Ca(CN)_2$ is 640°. The equilibrium $Ca(CN)_2 \rightleftharpoons CaCN_2 + C$ has been studied. It is not influenced by the presence of CaF_2, CaO, or $CaCl_2$ but is shifted to the left by NaCl. F. J. G.

Oxidation of difficultly oxidised substances in superheated systems. I. G. SCHAFRAN (J. Appl. Chem. Russ., 1938, **11**, 561—563).—B and W carbides are oxidised by boiling with 8 : 1 H_2SO_4–HNO_3 in a special apparatus. R. T.

Reducibility of earth chlorides by hydrogen. L. HOLLECK (Angew. Chem., 1938, **51**, 243—251).—The mixed trichlorides, dehydrated and heated in a Au boat in H_2 at 800° for 14 hr., are partly reduced to the metals, which alloy with the Au, whilst the remaining salt is partly reduced to dichlorides. The distribution of the several metals in the initial material and in the final salt and metallic products has been determined by *X*-ray methods. The readiness of reduction to metal increases with increasing at. no. for La to Lu and also follows the order La < Y < Sc. Sm, Eu, and Yb are exceptional, being more difficult to reduce to metal and being the only metals which remain in the product as dichloride. The relative ease of reduction to metal of the other chlorides is ascribed to the high temp. coeff. of the free energy of the reduction reaction, and the exothermic reaction with Au. The kinetics of the reactions are discussed. J. W. S.

Formaldehyde from percarbonate. E. BAUR (Helv. Chim. Acta, 1938, **21**, 433—437).—CH_2O is produced when cold aq. $K_2C_2O_6$ or $KHCO_3$–H_2O_2 is treated with peroxidase or catalase. The yield $\propto [H_2O_2]$. E. S. H.

Evaporation of silicon as a lower oxide. W. BILTZ and P. EHRLICH (Naturwiss., 1938, **26**, 188).—A mixture of Si and SiO_2 in equal proportions was heated in an evacuated vessel to 1250—1400°. The mixture evaporated almost completely, and a yellowish-brown, vitreous sublimate was obtained. This is probably due to the formation of SiO. A. J. M.

Titanium. X. Lead metatitanate. A. V. PAMFILOV, E. G. IVANTSCHEVA, and M. A. RABKIN (J. Appl. Chem. Russ., 1938, **11**, 398—402).—The prep. of $PbTiO_3$ is described, and its *X*-ray spectrum is determined. The stability of oil paints containing $PbTiO_3$ to atm. factors is determined. R. T.

Preparation of pure metals. A. E. VAN ARKEL (Mét. et Corros., 1937, **12**, 219—226).—Difficulties underlying the production of metals free from O_2 or dissolved oxides which markedly affect their chemical and physical properties, and the effect of the O_2 and N_2 content on the properties of V and Th, are discussed. The prep. of pure metals by the thermal dissociation of their volatile halides is described. The properties of Zr, Ti, V, Th, and Ta so prepared are compared with those of samples prepared by other methods. R. B. C.

Corrosion of tin in carbonate solutions.—See B., 1938, 528.

Basic phosphates of bivalent metals. II. Lead hydroxyapatite. R. KLEMENT (Z. anorg. Chem., 1938, **237**, 161—171).—When $PbHPO_4$ is shaken with 0·01N-NaOH *Pb hydroxyapatite*, $Pb_{10}(PO_4)_6(OH)_2$ (I), is formed. It has *a* 9·90, *c* 7·29 A, *c*/*a* 0·736. (I), and not $Pb_3(PO_4)_2$ (cf. A., 1909, ii, 670), is the product when $Pb(OAc)_2$ is pptd. with Na_2HPO_4, and the substance described by Zamboni and Ferrari (A., 1928, 694) as $Pb_3(PO_4)_2$ was actually (I). Pure $Pb_3(PO_4)_2$ is formed by the prolonged action of H_2O or of an acetate buffer (p_H 4·6) on $PbHPO_4$. It exists in two forms, monoclinic and rhombic, the latter being stable at room temp. F. J. G.

Reaction of ammonium chloride with nitric acid. B. B. VASSILIEV, J. A. RAVDIN, and E. I. LUKJANOVA (J. Gen. Chem. Russ., 1937, 7, 2913—2918).—NH_4NO_3 is not formed from aq. NH_4Cl and HNO_3 at 100°; the reactions are $2HNO_3 \rightarrow N_2O_4 + H_2O + O$; $N_2O_4 + H_2O \rightarrow HNO_2 + HNO_3$; $HNO_2 + NH_4Cl \rightarrow HCl + NH_4NO_2$; $NH_4NO_2 \rightarrow 2H_2O + N_2$; $3HCl + HNO_3 \rightarrow NOCl + Cl_2 + 2H_2O$. At lower temp., or in presence of nitrates (KNO_3, NH_4NO_3), the reaction $NH_4Cl + HNO_3 \rightarrow NH_4NO_3 + HCl$ predominates. R. T.

Reduction of nitrous acid by cysteine and glutathione.—See A., 1938, II, 222.

Thiophosphoryl fluoride and a salt of thiodifluorophosphoric acid H[PSF$_2$O]. W. LANGE and K. ASKITOPOULOS (Ber., 1938, **71**, [*B*], 801—807).—PSF_3, obtained by heating P_2S_5 with PbF_2 in N_2, has b.p. −52·6°/760 mm., mol. heat of evaporation 4·73 kg.-cal. It is unimol. in the gaseous state. Hydrolysis with aq. alkali is not instantaneous; the various intermediate phases cannot be quantitatively determined. The solution gives the reaction for S'' whilst addition of Ag_2SO_4 causes loss of S (as Ag_2S) from $(PSOF_2)'$ which thus passes into $(PSO_2F)''$ isolated as the nitron salt. Addition of nitron acetate to the freshly obtained solution of PSF_3 in H_2O leads to *nitron thiodifluorophosphate*, $C_{20}H_{16}N_4,HSPO_2F$, m.p. 225·8°. H. W.

Magnesium ammonium arsenate and alkaline-earth arsenates. V. AUGER and (MLLE.) N. IVANOFF (Compt. rend., 1938, **206**, 754—756).—The prep. of the *salts* $MgNH_4AsO_4,H_2O$, $M^{II}NH_4AsO_4,7H_2O$ (M^{II} = Ca, Sr, Ba), and $Sr(NH_4)_4(AsO_4)_2,10H_2O$ is described; the loss of NH_3 and H_2O from these salts, and from $MgNH_4AsO_4,6H_2O$, on heating in air or NH_3 has been investigated. The prep. of the *salts* $CaNH_4(nAsO_4mPO_4),7H_2O$ (containing 41% of arsenate), $Ba_3(AsO_4)_2,1SH_2O$, $Sr_3(AsO_4)_2,1SH_2O$, and $Ca_3(AsO_4)_2,6—7H_2O$ is also described. A. J. E. W.

Exchange reaction of oxygen atoms between carbonate ion and water. T. TITANI, N. MORITA, and K. GOTO (Bull. Chem. Soc. Japan, 1938, **13**, 329—330).—Preliminary experiments with K_2CO_3 and aq. $H_2{}^{18}O$ indicate the absence of an exchange between the O atoms of CO_3'' and H_2O. F. L. U.

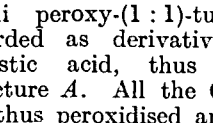
Simultaneous oxidation of β-naphthol and sodium sulphite.—See A., 1938, II, 230.

Action of sulphuric acid on metals and alloys.—See B., 1938, 530, 531.

Precipitation of chromates. P. E. PELLETIER, L. CLOUTIER, and P. E. GAGNON (Canad. J. Res., 1938, **16**, **B**, 37—45).—In the pptn. of Cu, Cd, Co, Zn, and Fe chromates at room temp. the concn. of the metallic salt solutions was kept const. and that of the $KCrO_4$ varied. Solutions were mixed in <0·1 sec., the rate of mixing being accurately determined. By analysis of the ppt. for CrO_3 and metal, the ratio of oxide to CrO_3 was determined; if this ratio remained const. with varying concn. of reactants, a definite compound was indicated. Cd and Co always gave normal chromates, whilst Zn and Fe^{III} gave only basic mixtures. The Cu ppt. approached that of the normal chromate. D. F. R.

The molybdic acid H_4MoO_5. V. AUGER (Compt. rend., 1938, **206**, 913—915).—The yellow deposits obtained on keeping aq. $(NH_4)_6Mo_7O_{24}$ containing HNO_3 are not pure H_4MoO_5 (I), and usually contain NH_3. Pure (I) is pptd. from dil. H_2SO_4 solutions of MoO_3 on long keeping, and from conc. HCl solutions of MoO_3 in 2—3 days. (I) gives MoO_3,H_2O when heated at 50—55°. The supposed yellow colour and oxidising action of aq. (I) are due to silicomolybdic acid formed by attack of the glass container. Aq. (I) deposits amorphous scales on evaporation; these are readily sol. in H_2O, and give NH_4 octamolybdate on treatment with $(NH_4)_2SO_4$. A. J. E. W.

Peroxy-compounds. I. Crystalline peroxytungstates. II. Mode of union of active oxygen in the alkali tetraperoxy-(1 : 2)-tungstates. Evaluation of the "Riesenfeld test." K. F. JAHR and E. LUTHER (Ber., 1938, **71**, [*B*], 894—903, 903—907).—I. A crit. survey of the lit. combined with experiment shows that a homogeneous salt of type $R_2O,WO_3,4O_{Act.},aq.$, the yellow alkali tetraperoxy-(1 : 1)-tungstates, separates from neutral or slightly alkaline solutions rich in H_2O_2. In strongly alkaline solution these pass into colourless compounds, probably by addition of Na_2O_2. A second homogeneous type, the alkali tetraperoxy-(1 : 2)-tungstates, $R_2O,2WO_3,4O_{Act.},aq.$, separates from feebly acidic solutions rich in H_2O_2. These compounds are all colourless and much more stable than the yellow compounds when solid. In both types all the O is in peroxidic union. There is no certain evidence of the existence of cryst. peroxyhexatungstates or other peroxypolytungstates richer in O. Certain observations in solutions of alkali polytungstates poor in H_2O_2 compel the conclusion that peroxidised polytungstic acids exist in these solutions. The constitution of the peroxytungstates has not been elucidated with certainty but the following working hypothesis is advanced. The alkali peroxy-(1 : 1)-tungstates are regarded as derivatives of monotungstic acid, thus having the structure *A*. All the O of the acid are thus peroxidised and the yellow colour of the salt can be ascribed to ·O·O· combined



(*A*.)

at either end with W. The conception that the salts are derived from a tetraperoxymonotungstic acid involves the assumption that they exist in H_2O in simple mol. distribution. The assumption that the alkali tetraperoxy-(1 : 2)-tungstates are salts of a diperoxymonotungstic acid is adequate to explain their behaviour. The total active O in them is in peroxidic union. Since the salts are colourless it may possibly be assumed that the "per-oxygen" is present in perhydroxy-, not peroxy-, groups. This type is most simply formulated $R'[HWO_6]$,aq., or $O\!\gg\!W\!<^{O\cdot OH}_{O\cdot OR}$. If these salts are derived from a monobasic diperoxytungstic acid they must be in simple mol. distribution in H_2O. This conclusion is confirmed by Brintzinger's dialysis method.

II. Treatment of K_2 tetraperoxy-(1 : 2)-tungstate with KI at p_H 6·15 and 7·00 indicates the presence of 89·4% and 85·0% of the O in true peroxidic form, whereas at p_H 8·25 only 49·7% of such O is indicated. At suitable [H·] Riesenfeld's test confirms Kellner's conclusion that the total active O is in peroxidic union. In general the method is not very suitable since almost unavoidable changes of p_H in the solution may completely alter the results. H. W.

Alleged existence of compounds of bivalent uranium. R. FLATT and W. HESS (Helv. Chim. Acta, 1938, **21**, 525—529).—Attempts to produce US are described. No evidence for the existence of U^{II} compounds was found (cf. Alibegoff, A., 1886, 855). E. S. H.

Fluoronitrites and fluoronitrates. E. ZINTL and W. HAUCKE (Z. anorg. Chem., 1938, **237**, 45—46).—The compound described by Beck (A., 1938, I, 93) as Na_3NF_6 is actually $NaHF_2$ with small amounts of impurities. F. J. G.

Risk of explosion in the use of perchloric acid. —See A., 1938, II, 252.

Recovery of iodine and cadmium from cadmium sulphide titration solutions. G. FICKER (Chem.-Ztg., 1938, **62**, 288).—The solutions containing $CdCl_2$, HI, and S are filtered to remove S. I is pptd. by excess of saturated aq. $NaNO_2$. After nearly neutralising the decanted liquid with NaOH, and boiling, $CdCO_3$ is pptd. by addition of solid K_2CO_3. I. C. R.

Formation of hydrogen peroxide by the action of iodine on water. D. I. SAPOSHNIKOV (J. Gen. Chem. Russ., 1937, **7**, 2879—2883).—Small amounts of H_2O_2 are formed when I is added to Ag_2SO_4 in dil. H_2SO_4, the reactions being probably: $H_2O + I_2 \rightarrow HI + HOI$; $2HOI + Ag_2SO_4 \rightarrow 2AgOI + H_2SO_4$; $AgOI + H_2O \rightarrow AgI + H_2O_2$. R. T.

Artificial manganese metasilicate. N. L. DILAKTORSKI (Trav. Inst. Pétrol. Acad. Sci. Leningrad, 1934, **6**, 369—379).—Rose-coloured synthetic rhodonite ($MnSiO_3$) with 3·8% of tephroite and SiO_2 was obtained (m.p. 1310°, d 3·766). CH. ABS. (*e*)

Production of spectroscopically pure iron. A. GATTERER and J. JUNKES (Naturwiss., 1938, **26**, 187).—Fe showing spectroscopically only traces of Si and about 0·0002% Cu is manufactured by the Molybdenum Co. Spectroscopically pure Fe_2O_3 can also be obtained. A. J. M.

Magnetic calcination residues. C. COURTY (Compt. rend., 1938, **206**, 911—913; cf. A., 1936, 1190; 1937, I, 199).—The strongly magnetic residue obtained on heating the ferric cupferron complex, in presence of a large excess of cupferron (I), has been shown by X-ray analysis to be rhombohedral Fe_2O_3. The val. of χ obtained for the residue is independent of the excess of (I), provided that all the C is burned away on ignition; traces of Fe can thus be determined magnetically after conversion into the (I) complex. The presence of Cu vitiates the results. A. J. E. W.

Corrosion of alloys by solutions of ammonium salts in liquid ammonia.—See B., 1938, 531.

Constitution of the green peroxo-cobalt-ammines. K. GLEU and K. REHM (Z. anorg. Chem., 1938, **237**, 79—88).—An improved method for the prep. of the acid sulphate of the green μ-peroxo-decammino-cobaltic series is described. The degree of oxidation of the Co has been determined by reduction with As_2O_3 in presence of OsO_4 as a catalyst. The results indicate that one of the Co atoms is quadrivalent, and the formula of the salt is $[(NH_3)_5Co^{III}\cdot(O\cdot O)\cdot Co^{IV}(NH_3)_5](SO_4)_2(SO_4H),3H_2O$. It is paramagnetic, and measurements of χ at a series of temp. give a magneton no. in approx. agreement with theory (1·73) for one Co^{IV} atom. F. J. G.

Ruthenium ammines. V. Further luteo- and purpureo-salts of ruthenium [and of cobalt and chromium]. K. GLEU, W. CUNTZE, and K. REHM. **VI. Roseo-salts of ruthenium.** K. GLEU and W. CUNTZE. **VII. Praseo-salts of ruthenium. Dichloro-series.** K. GLEU and W. BREUEL (Z. anorg. Chem., 1938, **237**, 89—100, 187—196, 197—208).—V. The following *salts* are described: $[Ru(NH_3)_6]Cl_3$, $[Ru(NH_3)_6]Br_3$, $[Ru(NH_3)_6](NO_3)_3$, $[Ru(NH_3)_6](NO_3)_3,HNO_3$, $[Ru(NH_3)_6]_2(S_2O_6)_3,4H_2O$, $[Ru(NH_3)_6](S_2O_6)Cl,H_2O$, $[Ru(NH_3)_6](S_2O_6)Br,H_2O$, $[Ru(NH_3)_6](SO_4)Br$, $[Ru(NH_3)_5Cl](NO_3)_2$, $[Ru(NH_3)_5Cl]SO_4,2H_2O$, (also *anhyd.*), $\{[Ru(NH_3)_5Cl]SO_4\}_4,3H_2SO_4$, $[Ru(NH_3)_5Cl]S_2O_6$. For comparison the following new *cobalti-* and *chromi-ammine salts* have been prepared: $[Co(NH_3)_6]_2(S_2O_6)_3,4H_2O$, $[Cr(NH_3)_6]_2(S_2O_6)_3,4H_2O$, $[Co(NH_3)_6](S_2O_6)Cl,H_2O$, $[Cr(NH_3)_6](S_2O_6)Cl,H_2O$, $[Co(NH_3)_6](S_2O_6)Br,H_2O$, $[Cr(NH_3)_6](S_2O_6)Br,H_2O$. In all cases the Ru salts are completely analogous to the Co and Cr salts.

VI. When $[Ru(NH_3)_5Cl]Cl_2$ (I) is dissolved in warm aq. NH_3 and the cooled solution treated with $(NH_4)_2S_2O_6$, *hydroxopentamminoruthenium dithionate*, $[Ru(NH_3)_5(OH)](S_2O_6)$ (II), is pptd. With aq. $H_2S_2O_6$ this affords the *aquopentamminodithionate*, $[Ru(NH_3)_5(H_2O)]_2(S_2O_6)_3,2H_2O$ (III). The corresponding *Co salt*, $[Co(NH_3)_5(H_2O)]_2(S_2O_6)_3,2H_2O$, has been prepared by treating $[Co(NH_3)_5(OH)]S_2O_6,2H_2O$ with AcOH. From the ammoniacal solution of (I) conc. HNO_3 ppts. the *aquopentammino-nitrate*, $[Ru(NH_3)_5(H_2O)](NO_3)_3$, and this in vac. over P_2O_5 affords the *nitrato-nitrate*, $[Ru(NH_3)_5(NO_3)](NO_3)_2$. Solutions of the aquopentammino-salts of Ru are

more acidic than those of Ir, Rh, Co, or Cr, and can be titrated as monobasic acids using phenolphthalein. (II) and (III) are paramagnetic and have mol. moments of approx. 2 Bohr magnetons.

VII. When $[Ru^{II}(NH_3)_4(SO_2)Cl]Cl$ is oxidised with ICl in aq. HCl, *dichlorotetramminoruthcnium iodochloride*, $[Ru^{III}(NH_3)_4Cl_2](ICl_2)$, is pptd. With H_2SO_3 in presence of dil. HCl this affords the *dichlorotetrammino-chloride*, $[Ru(NH_3)_4Cl_2]Cl,H_2O$ (IV), and from this by double decomp. other *dichlorotetrammino salts* may be prepared, viz., $[Ru(NH_3)_4Cl_2]Br$, $[Ru(NH_3)_4Cl_2](NO_3),H_2O$, $[Ru(NH_3)_4Cl_2](SO_4H)$ (V), $[Ru(NH_3)_4Cl_2](SO_4Ag)$, $[Ru(NH_3)_4Cl_2]_2(SO_4)$, $[Ru(NH_3)_4Cl_2]_2(S_2O_6)$. They are orange-coloured salts in which Ru is tervalent. Their analogy with the *praseo*-cobaltic salts establishes their configuration as *trans*, but the Cl is more firmly bound. They are paramagnetic, and (IV) and (V) have mol. moments of approx. 2 Bohr magnetons. F. J. G.

Complex compounds of platinum metals with thio-, seleno-, and telluro-ethers. I. *cis-trans*-Groupings. E. FRITZMAN and V. KRINITZKI (J. Appl. Chem. Russ., 1938, **11**, 195—213).—Theoretical. The concepts of org. chemistry are applicable to the isomerism of Pt complexes, the orientation of which may be predicted from a knowledge of the orienting, polarising, and steric effects of the substituents. R. T.

Corrosion of metals.—See B., 1938, 524, 525, 531.

Metal carbonyls. V. Physiological properties. VI. Derivatives. W. E. TROUT, jun. (J. Chem. Educ., 1938, **15**, 77—83, 145; cf. A., 1938, I, 208).—A summary. L. S. T.

Reactions of methylene-blue with metallic salts.—See A., 1938, II, 249.

Choice of coloured indicators for acidimetry and alkalimetry. L. MALAPRADE (Ann. Chim. Analyt., 1938, [iii], **20**, 89—94).—The graph constructed enables the correct indicator to be chosen for a titration, when the ionisation const. of acid or base is known, of an acid by a strong base and vice versa, and for that of the salt of a weak base (or acid) by a strong acid (or base). It indicates the jump in p_H that occurs at the end of the reaction, and the indicator is chosen so that its zone of colour change falls within this range. L. S. T.

Ammonium phosphate test, a useful aid in qualitative analysis. G. BÄHR (Z. anal. Chem., 1938, **112**, 169—171).—The presence of Cl′, Br′, SO_4'', S″, etc. in insol. salts and minerals can often be detected by heating the dry salt with 3—4 times its wt. of $(NH_4)_2HPO_4$, when the NH_4 salt of the anion sublimes, and can be dissolved and tested. Heating is conveniently carried out in a small tube, the lipped end of which rests inside the constricted end of a wider tube, open at both ends. The sublimate collects in the larger tube and can be obtained free from the melt. J. W. S.

Colorimetric determination of fluorides in water.—See B., 1938, 597.

Rapid determination of sulphur in inorganic substances. A. SCHÖBERL and H. SENF (Z. anal. Chem., 1938, **112**, 171—174).—A modified and cheapened form of combustion and absorption apparatus for use in the determination of S in sulphates, pyrites, etc. by Grote and Krekeler's method (B., 1933, 290) is described. S in $CaSO_4$ cannot be determined by this method. J. W. S.

Determination of sulphur in pyrites.—See B., 1938, 510.

Determination of sulphur in combustible materials.—See B., 1938, 478.

Determination of traces of hydrogen sulphide and carbon oxysulphide in soil air.—See B., 1938, 510.

Determination of hydrogen sulphide in coke-oven gas.—See B., 1938, 474.

Potentiometric determination of water-soluble sulphates. A. B. SCHACHKELDIAN (J. Appl. Chem. Russ., 1938, **11**, 546—549).—Excess of 0·1N-$Pb(NO_3)_2$ is added to the solution (previously freed from Ni, Fe, or Cd, by methods given), and the excess of $Pb(NO_3)_2$ is electro-titrated with standard Na_3PO_4 [Pt–$K_3Fe(CN)_6$–$Pb_2Fc(CN)_6$ electrode]. R. T.

Determination of sulphuric acid in concentrated nitric acid.—See B., 1938, 508.

Iodometric determination of sulphates in water.—See B., 1938, 597.

Determination of total sulphates in soils and irrigation water.—See B., 1938, 559.

Colorimetric determination of nitrate in presence of nitrite. G. V. L. N. MURTY (Proc. Indian Acad. Sci., 1938, **7**, **A**, 108—112; cf. A., 1937, 1, 261).—Removal of NO_2' by addition of $CO(NH_2)_2$ permits the accurate colorimetric determination of aq. NO_3' with $OH{\cdot}C_6H_4{\cdot}SO_3H$ (I) or preferably α-$OH{\cdot}C_{10}H_6{\cdot}SO_3H$ (II). Initial quant. oxidation of NO_2' to NO_3' by H_2O_2 (aided by a trace of $Fe^{\cdots}$) involves a determination of NO_2', and for total NO_3' results are progressively high, equally with (I) or (II), if $[NO_2']$ is >0·33 mg. I. McA.

Colorimetric determination of nitric acid in spent sulphuric acid.—See B., 1938, 508.

Determination of nitrates in water by means of diphenylamine.—See B., 1938, 597.

Determination of nitrate-nitrogen in fertilisers.—See B., 1938, 560.

Titrimetric determination of phosphoric acid. W. RATHJE (Angew. Chem., 1938, **51**, 256—258).—The phosphate solution, acidified with $HClO_4$ and containing 1 c.c. of 1% KI, is boiled and titrated, while boiling, with $BiOClO_4$. The end-point is reached when red BiOI, which is slightly more sol. than $BiPO_4$, is pptd. The influence of salts and org. substances is discussed, and methods for their removal are indicated. C. R. H.

Titrimetric determination of phosphoric acid in yeast.—See B., 1938, 571.

Micro-determination of arsenic. A. E. HOW (Ind. Eng. Chem. [Anal.], 1938, **10**, 226—232).—A modified Gutzeit procedure, sensitive to 0·01 μg. of As and capable of determining 0·1 μg. with a probable

error of 5%, is described. Optimum conditions have been found for each variable in the determination. L. S. T.

Determination of arsenic in metallurgical agglomerates.—See B., 1938, 528.

Volumetric determination of small amounts of boron in natural waters.—See B., 1938, 597.

Micro-analysis of silicates. F. HECHT (Mikrochim. Acta, 1937, **2**, 188—208).—Eight samples, each of 10—20 mg., are taken for the determination of SiO_2; Al_2O_3, total Fe, CaO, MgO, TiO_2, and MnO; H_2O (<110°) and P_2O_5; H_2O (>110°); total S; Na_2O and K_2O; FeO; CO_2. Full details of analysis, which is based on recognised microchemical methods, are given. C. R. H.

Determination of soluble silica in drinking and natural waters.—See B., 1938, 597.

Spectrum analysis of glass.—See B., 1938, 512.

Determination of carbon monoxide.—See B., 1938, 474, 510.

Determination of cyanide by Liebig's method. V. V. MALGIN (Plant Protection, U.S.S.R., 1935, No. 6, 23—28).—In determining HCN in the atm., 2% KOH should be used as absorbent and KI should be added to sharpen the end-point of the $AgNO_3$ titration. CH. ABS. (*e*)

Potassium and other salts of dinitro-β-naphtholsulphonic acid, and the application of the anion of this acid to the determination of potassium ions. E. P. VOLOTSCHNEVA (J. Appl. Chem. Russ., 1938, **11**, 369—373).—The solubility of 1 : 5 : 2 : 7-$(NO_2)_2C_{10}H_5(OH)\cdot SO_3K$ rises from 0·0673% at 0° to 0·493% at 55°, and that of the Ca salt from 1·35% at 16% to 11·71% at 55°. The K salt is readily sol. in alkaline solutions, less so in acid ones. Solutions of the Ca and K salts give ppts. with a no. of cations, substitution of the OH-H taking place. K is determined by heating the ppt. of K salt with H_2SO_4, and weighing the residue of K_2SO_4; this method is inapplicable in presence of Rb, NH_4, Li, Co^{II}, Ni^{II}, Cu^{II}, or Fe^{II}, or in presence of considerable excess of Zn, Mg, Mn^{II}, Pb^{II}, Na, or C_2O_4''. R. T.

Determination of potassium in silicates with a cobalt nitrite complex containing silver. G. V. TANANOIJES (Trans. Ukrain. Sci. Res. Inst. Bldg. Mat., U.S.S.R., 1931, 10).—K is pptd. as $K_2PbCo(NO_2)_6$ by means of a Na cobaltinitrite solution containing Pb. The ppt. is impure and a correction factor must be determined by experiment. A 2% accuracy is obtained. CH. ABS. (*e*)

Determination of small amounts of potassium in aluminium and magnesium.—See B., 1938, 532.

Determination of sodium in aluminium and aluminium–silicon alloys.—See B., 1938, 532.

Sulphide–iodometric determination of small amounts of silver. A. G. BOSIN and S. C. GINTZBURG (J. Appl. Chem. Russ., 1938, **11**, 528—529).—10—12 drops of conc. aq. Na_2S are added to the solution (in absence of ions precipitable by Na_2S, other than $Ag^{\cdot}$), the solution is centrifuged, and the ppt. is washed, suspended in 5 ml. of 1 : 1 HCl, and shaken with 0·01N-I in KI, excess of which is titrated. 0·1—80 mg. of Ag may thus be determined, with an error of 0·01—2·3 mg. R. T.

Iodometric determination of silver. C. K. DEISCHER and W. M. MCNABB (J. Chem. Educ., 1938, **15**, 86—87; cf. A., 1936, 951).—The $Ag^{\cdot}$ is titrated in acid solution with standard aq. KI, using starch and Ce^{IV} NH_4 sulphate as indicators, until a permanent blue-green colour is obtained. The indicator correction must be determined. The method is applicable in presence of $Cu^{\cdot\cdot}$. Comparisons with the Volhard and the gravimetric AgCl method are satisfactory. L. S. T.

Electrolytic determination of silver from potassium cyanide solution. D. TSCHAVDAROV (Z. anal. Chem., 1938, **112**, 258—265).—The method is more accurate if the solution is hot, and if KOH and CH_2O are present. Details of an improved procedure are given. F. J. G.

Determination of calcium nitride in calcium cyanamide.—See B., 1938, 509.

Titrimetric determination of gypsum in cement.—See B., 1938, 517.

Determination of hardness of waters containing phosphates.—See B., 1938, 596.

Analytical chemistry of beryllium. R. GADEAU (Compt. rend. XVII Cong. Chim. Ind., 1937, 702—707).—Methods in use for the analysis of beryl, Be salts, and alloys of Fe, or Cu, or Al with Be, are described. In general, these involve elimination of SiO_2, removal of Fe and heavy metals by means of H_2S in ammoniacal tartrate solution, pptn. of Al with 8-hydroxyquinoline in presence of AcOH, and pptn. of Be as phosphate in the dil. AcOH solution. L. S. T.

Separation of magnesium from potassium and sodium with "Triton B." T. KROKOWSKI (Z. anal. Chem., 1938, **112**, 183—186).—In the absence of $NH_4^{\cdot}$, $Mg^{\cdot\cdot}$ can be pptd. quantitatively as $Mg(OH)_2$ by the addition of 50% excess of the base "Triton B" (I), thus permitting its separation from $Na^{\cdot}$ and $K^{\cdot}$. Addition of a further 9 c.c. of 2·5N-(I) per 1 g. of NH_4Cl present causes quant. pptn. of $Mg(OH)_2$ even in presence of $NH_4^{\cdot}$. J. W. S.

Rapid determination of magnesium in magnesites and dolomites.—See B., 1938, 508.

Determination of magnesium in presence of metals of the third and fourth groups.—See B., 1938, 533.

Precipitation of zinc as zinc salicylaldoxime. T. G. PEARSON (Z. anal. Chem., 1938, **112**, 179—182).—At p_H 6·5 $Ni^{\cdot\cdot}$ is pptd. completely by salicylaldoxime (I), whereas $Zn^{\cdot\cdot}$ is pptd. only at p_H 7—8. To ppt. Zn, 50% excess of 1% aq. (I) is added to the slightly acid solution with a drop of phenol-red, and 0·1N-NaOH is added until the indicator is pale red. After being kept overnight the ppt. is collected, washed with cold H_2O, and dried for 5 hr. at 80°. J. W. S.

Postprecipitation of zinc sulphide with bismuth sulphide. I. M. KOLTHOFF and F. S. GRIFFITH (J. Physical Chem., 1938, **42**, 531—539; cf. A., 1932, 481; 1936, 1194).—ZnS is postpptd. with Bi_2S_3, but Zn can be separated quantitatively from Bi with H_2S provided that the [HCl] after pptn. is $<0{\cdot}3$N and the solution is filtered within a few min. The rate of postpptn. with Bi_2S_3, like that with CuS, is small initially and increases with increasing time of contact. The efficiencies of HgS and ZnS in promoting pptn. of ZnS are > those of Bi_2S_3. Brief periods of ageing increase the efficiency of Bi_2S_3, but after longer periods it becomes less effective. ZnS can be extracted with 2N-HCl from mixtures with Bi_2S_3 and CuS, but not from HgS, since in the latter case it is incorporated as mixed crystals. Addition of NaCl to a solution inhibits postpptn. of ZnS with Bi_2S_3 and CuS. J. W. S.

Co-precipitation and p_H value in precipitations with 8-hydroxyquinoline. H. V. MOYER and W. J. REMINGTON (Ind. Eng. Chem. [Anal.], 1938, **10**, 212—213).—Zn is completely pptd. between p_H 4·6 and 9·3, and co-pptn. of Mg with the Zn begins at p_H 5·5, 2 units lower than reported (A., 1933, 922) for pptn. of Mg alone. Zn and Mg can be separated only if the p_H is kept between 4·6 and 5·5. Fe and Al can be separated if the p_H of the solution is kept between 3·5 and 4·0. Al is not pptd. at p_H 4·10 in absence of the Fe. Co-pptn. of Mg on the Zn salt of 8-hydroxyquinoline at p_H 5·95 and of Al on the Fe^{III} salt of 8-hydroxyquinoline increases in accordance with the Freundlich adsorption equation up to a limiting concn., above which the amount carried down remains const. Co-pptn. is probably adsorption on the surface of the ppt. L. S. T.

Rapid determination of zinc in zinc-copper sulphide ores and their concentrates.—See B., 1938, 527.

Crystallisations carried out on a glass slide by evaporation of the solvent. II. Case of two substances without mutual action, or of two substances which form mixed crystals. J. SEIGLE (Chim. et Ind., 1938, **39**, 627—636; cf. A., 1938, I, 157).—The appearances resulting from the mode of distribution of the solutes relative to one another when aq. solutions of two salts, or of a salt and a dye, or alcoholic solutions of $C_{10}H_8$ and a dye, are evaporated on a glass slide, are described. F. J. G.

Galvano-electric determination of metals. II. Determination of lead. P. S. TUTUNDŽIĆ (Z. anorg. Chem., 1938, **237**, 38—44).—Pb can be determined by the method already described (A., 1930, 882) if gelatin and an excess of NaOAc are present. F. J. G.

Determination of thionalide complexes of lead, bismuth, and antimony. R. BERG and E. S. FAHRENKAMP (Z. anal. Chem., 1938, **112**, 161—169; cf. A., 1937, I, 476).—Pb can be separated from Ag, Cu, Zn, Co, Ni, Al, Fe^{III}, As^{III}, Cd, Cr^{III}, and Ti^{IV} by pptn. with 3—4 times the theoretical quantity of thionalide (I) (2% in EtOH) from cold SO_4''-free solutions containing 1—3 g. of Na tartrate and 3—5 g. of KCN per 100 c.c., and "N in OH'." The ppt. is washed with H_2O till free from CN' and with 50% aq. $COMe_2$ till free from (I), and is dried at 105°. Bi can be separated from the same metals and also from Hg^{II}, Pt, Pd, and V, whilst Sn can be separated from Ag, Fe^{II}, Co, Cr^{III}, Ti^{IV}, and Ce^{III}, both by the same process, excepting that the final washing is made with 10% aq. EtOH instead of aq. $COMe_2$. J. W. S.

Azo-dyes as adsorptional indicators. C. G. RAICHINSCHTEIN and N. KOROBOV (J. Appl. Chem. Russ., 1938, **11**, 550—554).—Benzopurpurin 4B, benzoazurin, Congo-corinth, and diamine-blue, -bengal blue, -fast bright blue, -brown, -bright red, -heliotrope, and -vermillion 6BS and 4B may be used as indicators in the titration of Pb'' with $(NH_4)_2MoO_4$. R. T.

Determination of lead in solders.—See B., 1938, 528.

Rapid determination of lead tetraethyl in motor fuels.—See B., 1938, 478.

Detection of copper, cobalt, and nickel. T. A. THOMSON (Mikrochim. Acta, 1938, **2**, 280—282).—By carrying out the pptn. with NH_4 mercurithiocyanate in a capillary 0·2—0·6 mm. in diameter and centrifuging, 1 p.p.m. of Cu and Co and 2 p.p.m. of Ni can be detected in a solution containing excess of Zn. K mercuriselenocyanate offers no advantage over the thiocyanate and is less stable. J. W. S.

Microchemical reactions of the mercurous ion. A. MARTINI (Mikrochim. Acta, 1938, **2**, 296—298).—Hg' and Hg'' are both pptd. by $K_2Co(CNS)_4$ or $K_2Zn(CNS)_4$, which are sensitive reagents for the detection of Hg but do not distinguish between its ionic states. Picrolonic acid yields ppts. only with Hg' and permits detection of quantities $<0{\cdot}01$ μg. J. W. S.

Action and distribution of mercury. XXVII. Microanalytical determination of mercury. A. STOCK and N. NEUENSCHWANDER-LEMMER (Ber., 1938, **71**, [*B*], 550—562).—The following points arise from a re-examination of the author's method of detecting traces of Hg (A., 1934, 270). Treatment of urine with Cl_2 is necessary and adequate. Similar treatment of solid org. matter is inadequate and $KClO_3$-HCl should be used for this reason and for the more complete destruction of org. matter, the presence of which can render the subsequent electrolysis incomplete by reason of complex formation. Volatilisation of $HgCl_2$ during evaporation of the aq. solution is prevented by the presence of HCl. Dil. solutions of $HgCl_2$ should be kept for as short a time as possible in glass or SiO_2 flasks since Hg is thereby adsorbed. In the electrolysis the amount of Cu can be advisedly reduced from 20 and 10 mg. to 5 mg., whereby the thinner cathodic Cu deposit is more resistant than that produced with larger amounts of Cu. The surface of the cathode is enlarged by use of a spiral; etching with HNO_3 has little effect. The Pt anode is placed immediately below the vertical cathode, which is thus always immersed in a dil. solution of Cl_2. An e.m.f. of 4 v. is suitable. The presence of 1% of HCl is very advantageous. $(NH_4)_2C_2O_4$ causes smoother and denser deposits of Cu but its amount requires very careful control and its presence may hinder the subsequent formation of a clean Hg

globule. Treatment of the distillation tube with alkali is unnecessary. H. W.

Microanalytical utilisation of diarylcarbazones. P. KRUMHOLZ and F. HÖNEL (Mikrochim. Acta, 1937, **2**, 177—183).—Reactions between Hg^{II}, Cu^{II}, Fe^{III}, and Cd salts, chromates, and molybdates and diphenyl-, di-α- and -β-naphthyl-, and di-*o*-, -*m*-, and -*p*-nitrophenyl-carbazones and -carbazides have been investigated. The sensitivity of the substituted diphenylcarbazones is > that of the unsubstituted compound. For Hg, Cu, and Fe the sensitivity in neutral solution is > in acid solution. In the case of Cd, alkaline solutions are used, and the reaction between Cd and di-β-naphthylcarbazone can be utilised in presence of large quantities of Cu, the Cu being retained in solution by means of KCN. Chromates are better detected by carbazides than by carbazones, the unsubstituted compound being the most sensitive. C. R. H.

Colour reactions between quadrivalent cerium and salts of aromatic acids. F. M. SCHEMJAKIN and A. N. BELOKON (Compt. rend. Acad. Sci., U.R.S.S., 1938, **18**, 275—276).—$Ce^{\cdots\cdot}$ gives dark-coloured ppts., lilac-black, reddish-brown, almost black, and bluish-green, respectively, with the NH_4 salts of naphthoic, anthranilic, and salicylic acids, and with phenylalanine (I). Except with (I), the ppts. are insol. in HCl. The reactions can be used on paper, but the sensitivity is not favourable. $Ce^{\cdots}$, Th, Pr, Nd, and Zr do not give coloured ppts. with these substances. L. S. T.

Cerate oxidimetry. Theoretical considerations and determination of approximate electrode reference potentials. G. F. SMITH and C. A. GETZ (Ind. Eng. Chem. [Anal.], 1938, **10**, 191—195).—The theory of the mechanism of ceric oxidimetry based on the assumption of a simple $Ce^{\cdots\cdot} : Ce^{\cdots}$ ratio is faulty as a guide to the interpretation of experimental results. In 1 to 8N-HNO_3 $Ce^{\cdots\cdot}$ has a potential of 1·61—1·56 v. and in 1 to 8N-$HClO_4$ 1·70—1·87 v. as compared with 1·44 v. in dil. H_2SO_4. These variations are best explained by assuming the formation of a complex cerate ion. Potentiometric titrations of $Fe^{\cdot\cdot}$ in different concns. of $HClO_4$, HNO_3, H_2SO_4, and HCl are represented graphically. Proposed new procedures in $HClO_4$ include the simultaneous differential oxidation of $Fe^{\cdot\cdot}$ and vanadyl salts, the determination of oxalate (including $Ca^{\cdot\cdot}$) with ferroin as indicator, and the titration of $AsO_3^{\cdot\cdot\cdot}$ to $AsO_4^{\cdot\cdot\cdot}$. L. S. T.

Determination of small quantities of cerium in copper welding wires.—See B., 1938, 527.

Rare earths. Determination of the rare earths by means of their arc spectra. C. N. MCCARTY, L. R. SCRIBNER, and M. LAWRENZ, with B. S. HOPKINS (Ind. Eng. Chem. [Anal.], 1938, **10**, 184—187).—The spectrographic determination of individual rare earths in their complex mixtures using an internal standard has been investigated. Zr oxide is better than MgO or Ce oxide as an internal standard, and the region 2500—3300 A. is the most suitable in no. and intensity of lines and in dispersion. The effects of other rare earths on the line intensities of a single rare earth is the same. The arc spectra of the rare earth oxides from numerous typical ores have been photographed, and the % of rare earth estimated by interpolation. Data given for the composition of 20 ores indicate that similar ores from different localities show marked variation in the % of the individual rare earths which they contain. Xenotime and allanite also appear to be better sources of Nd than is gadolinite. When applied to the determination of individual rare earths in an artificial mixture of rare earths of known composition the max. error of the method was found to be ±15%. L. S. T.

Quantitative spectrochemical analysis with the microphotometer. F. TWYMAN, G. F. LOTHIAN, and E. S. DREBLOW (J.S.C.I., 1938, **57**, 75—79; cf. A., 1930, 445).—Methods of quant. spectrochemical analysis are reviewed, and details are given of a rapid method of determining a minor constituent of an alloy by microphotometric comparison of the intensities of one of its spectrum lines and a line due to a suitable major constituent. The plot of log p_2/p_1 against log D_2/D_1 (p_1, p_2 being the percentages of the minor and major constituents, and D_1, D_2 being the corresponding microphotometer galvanometer deflexions) is independent of the exposure, and is in many cases a straight line. Changes in the plate and in development affect the vals. of log D_2/D_1 by a const. factor, which is determined by standard exposures on each plate. A const. slit width is used to minimise changes in the continuous background. The technique of the method, and its application to Al alloys, are described. A. J. E. W.

Detection and colorimetric determination of aluminium in water in presence of fluorides.—See B., 1937, 597.

Direct determination of aluminium in aluminium earths.—See B., 1938, 509.

Determination of aluminium oxide in steel.—See B., 1938, 522.

Determination of aluminium oxide in aluminium.—See B., 1938, 532.

Detection of indium with morin and of some heavy metals with cacothelin. G. BECK (Mikrochim. Acta, 1938, **2**, 287—290; cf. A., 1936, 1221).—Al, Ga, Sc, and In salts all show an intense green fluorescence in daylight when treated with an EtOH solution of morin. If this fluorescence is suppressed by NaF it is due to Al or Sc, if not suppressed by $(NH_4)_2CO_3$ it is due to Sc, and if not suppressed by ammoniacal tartrate solution it is due to Al. If the fluorescence is not suppressed by NaF and remains in the solution after saturation with H_2S it is due to Ga. 0·02 μg. of In can be detected in 1 c.c. of solution if the fluorescence is examined in ultra-violet light. Cacothelin is reduced to a violet dye by Sn^{II}, U^{IV}, Ti^{III}, Re^{III}, Nb^{III}, and lower oxides of Mo and W, enabling about 1 μg. of these metals to be detected. J. W. S.

Determination of manganese in silicate rocks. IV. New method of oxidation of manganese. O. HACKL (Z. anal. Chem., 1938, **112**, 174—179; cf. A., 1936, 813, 952).—Pt foil, but not Pt-black,

-sponge, or gauze, or platinised SiO_2, can be used to catalyse the oxidation of $Mn^{\cdot\cdot}$ to MnO_4' by $(NH_4)_2S_2O_8$ and H_2SO_4. The solution must be quite free from Cl', traces of which cause incomplete oxidation. It is suggested that this method could be applied to the colorimetric determination of traces of Cl'. The reaction is much less sensitive to the presence of F'. Any Ti present is oxidised with the $Mn^{\cdot\cdot}$, interfering with the colorimetric test. Addition of sufficient H_2SO_4 to suppress this oxidation also prevents complete oxidation of $Mn^{\cdot\cdot}$. J. W. S.

Determination of traces of manganese in natural waters, applying coagulation for its separation. V. T. Tschuiko (J. Appl. Chem. Russ., 1938, **11**, 530—533).—The p_H of the H_2O is adjusted to 11, and aq. $MgSO_4$ is added. The ppt. is collected, and Mn is determined in it by Marshall's method. Should the Mn content of the H_2O be $<0{\cdot}2$ p.p.m., it is evaporated down to this concn.; concns. of 0·0003 p.p.m. may thus be determined. $Mn^{\cdot\cdot}$ is not pptd. together with $Al(OH)_3$ at p_H 8·5; the Mn found in the ppt. under these conditions represents colloidal Mn. R. T.

Determination of manganese in steel and cast iron.—See B., 1938, 522.

Drop method of detection of rhenium. N. S. Poluektov (J. Appl. Chem. Russ., 1938, **11**, 534—538).—Three drops of conc. H_2SO_4 and 1 drop of 10% Br in conc. HBr are added to a drop of the solution, and the mixture is distilled. 1 ml. of conc. HBr is added to the distillate, the mixture is evaporated to dryness at 100° (to eliminate As, Se, and Ge), and the residue is warmed with H_2O_2, to convert $ReOBr_2$ into $HReO_4$. This is dissolved in a drop of H_2O, and 2N-tartaric acid and $SnCl_2$ are added, followed by 1% Na_2TeO_4, when a black ppt. or turbidity due to liberation of Te is obtained in presence of $<0{\cdot}5$ μg. Re; other metals do not interfere. Re is quantitatively pptd. by adding OsO_4 to the distillate, and saturating with H_2S; the solution is centrifuged, and the ppt. of Re_2S_7 is dissolved in 10% H_2O_2. Re is detected in the solution as above. R. T.

Principles and applications of absolute colorimetry. XVII. Absolute colorimetry of iron. A. Thiel, H. Heinrich, and E. van Hengel (Ber., 1938, **71**, [*B*], 756—758).—The presence of Mn does not interfere with the determination of $Fe^{\cdot\cdot}$ by 4 : 4′-dipyridyl (A., 1938, I, 97). Under certain conditions the reduction of $Fe^{\cdot\cdot\cdot}$ to $Fe^{\cdot\cdot}$ can be advantageously effected by SO_3'' or quinol in place of $Na_2S_2O_4$. The phenanthroline method is somewhat cheaper than the dipyridyl process. It is not affected by the presence of SiO_2, H_3PO_4, Ti, Al, Zn, Pb, Ag, Mg, Mn, Ni, and Cu but is sensitive to Co. The thiocyanate method is considered inferior in convenience. H. W.

Detection of ferro- and ferri-cyanide by catalysis. L. Szebellédy and M. Ajtai (Mikrochim. Acta, 1938, **2**, 299—305).—The fact that the oxidation of *p*-phenetidine (I) by H_2O_2 is catalysed by $Fe(CN)_6'''$ [or $Fe(CN)_6'''' + H_2O_2$] can be utilised for the detection of $Fe(CN)_6'''$ and $Fe(CN)_6''''$. 4 c.c. of the sample are treated with 0·5 c.c. of 0·025% solution of (I) in HCl and 0·5 c.c. of 0·2% H_2O_2, the colour produced after 1—10 min. being compared with that in a blank test carried out simultaneously. J. W. S.

Carborundum and silicon electrodes. II. Application of silicon and silicon carbide electrodes to titration of redox systems. J. A. Boltunov and Z. P. Kozmina (J. Gen. Chem. Russ., 1937, **7**, 2899—2902).—Electrotitration of $FeSO_4$, $K_4Fe(CN)_6$, Na_2SO_3, or Na_2S by $KMnO_4$, or of $FeSO_4$ by $K_2Cr_2O_7$, may be effected with a SiC indicator electrode, or of $FeSO_4$ by $KMnO_4$ or $K_2Cr_2O_7$, with a Si electrode. R. T.

Serial method of determining small amounts of iron in water.—See B., 1938, 597.

Determination of ferrous oxide in chromite.—See B., 1938, 520.

Micro-detection of cobalt. T. A. Thomson and E. M. Thomson (J. New Zealand Inst. Chem., 1937, **2**, 39—41).—Crystallographic and spot tests and quant. analysis are reviewed. S. M.

Postprecipitation of nickel sulphide with copper, mercuric, and zinc sulphides. I. M. Kolthoff and F. S. Griffith (J. Physical Chem., 1938, **42**, 541—545).—NiS is postpptd. with CuS, HgS, and ZnS. The effect of HgS is > that of CuS, whilst that of ZnS depends greatly on the p_H at which it is separated. The rate of postpptn. with CuS increases with rise of temp. NiS also catalyses its own pptn. J. W. S.

Photometric determination of molybdenum in steel.—See B., 1938, 523.

Colorimetric determination of minute amounts of tin in organic matter. N. Strafford (Mikrochim. Acta, 1938, **2**, 306—313).—Most of the org. matter is removed from the sample by oxidation with HNO_3 and H_2SO_4, after which Sn is pptd. with H_2S from slightly acid solution containing $CS(NH_2)_2$ to prevent pptn. of Cu. The ppt. is redissolved in HNO_3 and H_2SO_4, and all org. matter removed with the aid of periodic additions of H_2O_2. The resulting solution is reduced by Al in presence of HCl in an atm. of CO_2, and phosphomolybdate reagent is added. After mixing well, the Mo-blue formed is extracted with $C_5H_{11}\cdot OH$, the colour of the extract being measured. The concn. of Sn is deduced from the results of calibration tests with the same tintometer. The phosphomolybdate reagent comprises solutions of (*a*) 2·5 g. of H_2MoO_4 dissolved in 50 ml. of N-NaOH and diluted to 100 ml. with 2N-H_2SO_4; and (*b*) 0·44 g. of NaH_2PO_4,H_2O in 100 ml. of H_2O. For use, 10 ml. of (*a*) are mixed with 4 ml. of (*b*) and diluted to 100 ml. In presence of Ti, tartaric acid is added before pptn. with H_2S. J. W. S.

Fractional detection of titanium and uranium. N. A. Tananaev and A. Gintzburg (J. Appl. Chem. Russ., 1938, **11**, 364—366).—The solution is boiled with $SnCl_2$, filtered, and a solution of chromotropic acid is added, when a red or brown coloration indicates Ti. For detection of U the solution is boiled with excess of NH_3, and filtered. The residue is extracted with AcOH, and aq. $K_4Fe(CN)_6$ is added to the extract, when a brown coloration or ppt. indicates U. Should

Fe or Cr be present the filtrate is made acid with HCl, excess of KI is added, the I liberated is reduced with $Na_2S_2O_3$, and $K_4Fe(CN)_6$ is added. R. T.

Reaction of zirconium methylarsinate. Separation of zirconium from titanium, copper, and tin. R. CHANDELLE (Bull. Soc. chim. Belg., 1938, **47**, 172—193).—The separation of Zr and Ti by the Na_2AsMeO_3 method (A., 1937, I, 634) has been investigated. Direct addition of the reagent to a solution containing Zr and Ti ppts. the Zr, but the ppt. contains some Ti. To avoid this Zr is first pptd. by addition of aq. NH_3 and excess of H_2O_2. Ti remains in solution. The ppt. is collected and dissolved in HCl, after which Zr is pptd. as $Zr(AsMeO_3)_2$. Zr and Cu can be separated directly by the methylarsinate method. Sn^{IV} in 0·5N-HCl is not pptd. by Na_2AsMeO_3, but it is not possible to use the reaction for the separation of Zr and Sn as the ppt. of Zr carries down much Sn. A. J. M.

Drop reactions of vanadates and molybdates with 1-nitroso-β-naphthol. F. M. SCHEMJAKIN and A. N. BELOKON (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 277—278).—A saturated EtOH solution of 1 : 2-NO·$C_{10}H_6$·OH (I) gives a dark-green ppt. with an alkaline solution of NH_4 vanadate, and a brownish-red ppt. from a solution acidified with HCl. In neutral solution, there is no pptn. The brownish-red ppt. is sol. in KOH, conc. HNO_3, conc. H_2SO_4, and conc. HCl (incompletely). In dil. HCl solution the sensitivity is $\sim 5 \times 10^{-6}$ g. per ml. Pptn. in AcOH solution is less complete. For a drop reaction on paper the sensitivity is $\sim 1 \times 10^{-5}$ g. per ml. AcOH and EtOH solutions of (I) form a red ppt. with an acid solution of NH_4 molybdate (cf. A., 1924, ii, 788). The action of acids and bases is similar to that with the V ppts. Used as a drop reaction on paper four rings, (inner) orange, lilac, yellow, blue, may appear; sensitivity, 10^{-4} g. Mo per ml. In a solution acidified with HCl, AsO_3''' (?) gives a slight orange-red ppt. with (I). L. S. T.

Rapid potentiometric determination of vanadium in alloy steels etc.—See B., 1938, 523.

Detection of tervalent antimony. M. J. SCHAPIRO (J. Appl. Chem. Russ., 1938, **11**, 355).—0·5 ml. of 1% KI, 1 ml. of 20% NaOH, and 5 ml. of 0·01% $AuCl_3$ are added to 1 ml. of the solution, and the mixture is shaken, when a red colour appears in presence of $<0·01$ mg. Sb^{III}. Cu, Sn, As, Cd, Hg^{II}, Fe^{III}, Mn^{III}, Co^{II}, Ag, and Os interfere. R. T.

Micro-gravimetric determination of arsenic and antimony. F. HECHT and M. VON MACK (Mikrochim. Acta, 1937, **2**, 218—226).—As is pptd. as $MgNH_4AsO_4,6H_2O$ by means of MgO mixture in presence of NH_4Cl, and washed with aq. NH_3, EtOH, and Et_2O. Sb is determined as Sb_2S_3, use being made of a microfilter beaker surrounded by a two-piece Al block which can be heated for subliming the excess of S. The two methods have been combined in order to separate and determine As and Sb. C. R. H.

Micro-gravimetric separation of tin and antimony. M. VON MACK and F. HECHT (Mikrochim. Acta, 1937, **2**, 227—241).—The pptn. of Sn with $PhAsO_3H_2$ followed by ignition of the ppt. is not applicable to micro-determinations. Pptn. by means of aq. NH_3 and NH_4NO_3 and ignition of the ppt. is applicable only in absence of other metals. A method is outlined for pptg. Sn by means of cupferron, and if this is done in presence of tartaric acid and in absence of all but traces of alkali salts, Sn can be separated from Sb. Sb can be determined in the filtrate by the authors' method (cf. preceding abstract) if the cupferron is first oxidised by H_2O_2 in presence of NH_3. The application of the method to the analysis of alloys is discussed. C. R. H.

Determination of antimony in aluminium alloys.—See B., 1938, 533.

Colour reaction for the bismuth ion. N. V. VAVILOV (J. Appl. Chem. Russ., 1938, **11**, 356—363).—MeCS·NH_2 gives a yellow coloration with dil. solutions of Bi salts, serving for the detection of $<0·07$ mg. Bi in 0·1 ml. of solution; group IV metals do not interfere. Characteristic effects are obtained when the tests are made on filter-paper, according to the other cations present. R. T.

Detection of small amounts of gold, palladium, and platinum. M. J. SCHAPIRO (J. Appl. Chem. Russ., 1938, **11**, 367—368).—5—6 drops of starch solution and 5—6 drops of aq. 0·02% I are added to each of two test-tubes containing respectively 2 ml. of H_2O and of solution; a faint blue coloration is obtained in the former, but not the latter, solution, should it contain Au^{III}, Pd^{II}, Pt^{IV}, or Hg^{II} $<0·4$ μg., Hg^{I} 0·25, or Ag 0·05 μg. Co, Ni, Mn, Zn, Fe, Al, UO_2, Cd, Cu, Pb, As, Sb, Bi, Ce, Ta, Nb, Zr, La, Th, W, V, Mo, Te, Se, Os, and Tl do not interfere. R. T.

Ice point as a standard of reference. E. E. ROPER (J. Amer. Chem. Soc., 1938, **60**, 866—869).—A temp. of 0·000° can be maintained with an accuracy of ±0·001° by means of crushed ice in a Dewar tube, adopting White's washing technique (A., 1934, 246). E. S. H.

Micro-melting point and sublimation apparatus with completely built-in thermometer. L. FUCHS (Mikrochim. Acta, 1938, **2**, 317—328).—The apparatus comprises a metal box closed at the top by an electrically heated metal plate, on which is laid a glass plate to protect it from the air. A circular thermometer is fixed in a groove on the heating table. The crystals to be fused are enclosed between coverslips on a highly polished and blackened metal plate. For evaporation of solutions and sublimation of the residues the table contains two pits to carry small glass sublimation cups. The heating plate is so arranged that any portion can be brought into the field of a microscope. The max. m.p. deviations observed are ±1° at <200° and ±2° at >200°. J. W. S.

Applications of high frequency in chemistry. H. LEDUC (Compt. rend. XVII Cong. Chim. Ind., 1937, 798—802).—The use of high-frequency heating in chemistry and industry is reviewed. A. J. M.

Grating monochromator for the Schumann region. R. F. BAKER (J. Opt. Soc. Amer., 1938, **28**, 55—60).—The instrument described is suitable for photoelectric investigations at 500—3000 A. A H_2-tube light source, and a K photo-cell used in conjunction with a Compton electrometer for λλ <1000 A.,

are also described. Data for the photo-electric yield of Cd from the threshold to 1000 A. are recorded. A. J. E. W.

Electron-optical theory of present-day precision mass spectrographs. R. Herzog and V. Hauk (Z. Physik, 1938, **108**, 609—634).—An examination of the theoretical aspect of the geometry and functioning of mass spectrographs with particular reference to those of Bainbridge and Jordan, Dempster, and Aston. L. G. G.

Calibration wave-lengths for infra-red spectrometers. P. E. Shearin and E. K. Plyler (J. Opt. Soc. Amer., 1938, **28**, 61—62).—Suitable lines and bands in the range 2—24 μ. for HCl, H_2O, and CO_2 are tabulated. λλ of 11 sharp absorption maxima in EtOH and C_5H_{11}·OH, at 7—13 μ., suitable for calibration purposes, have been measured. A. J. E. W.

Infra-red and Raman spectra of polyatomic molecules. I. Automatic prism spectrometer for the infra-red. H. Gershinowitz and E. B. Wilson, jun. (J. Chem. Physics, 1938, **6**, 197—200).—Construction and operation of a spectrometer which contains two prisms, one of NaCl and the other of KBr, are described. The two prisms may be interchanged without opening the spectrometer housing or disturbing the calibration. A non-continuous, step-wise method of recording has been employed. W. R. A.

Quantitative spectrographic analysis. Treatment of graphite electrodes for evaporation of aqueous solutions. H. A. Wilhelm (Ind. Eng. Chem. [Anal.], 1938, **10**, 211—212).—A method of testing and reducing the penetration of solutions evaporated in the cup of a graphite electrode is described. L. S. T.

Vacuum spectrograph for region 2000—1000 A. B. K. Johnson (J. Sci. Instr., 1938, **15**, 126—128).—A vac. spectrograph with optical systems of CaF_2 and LiF is described. The most suitable illumination is the Sn spectrum. J. A. D.

Purification of graphite electrodes for spectrochemical analysis. G. W. Standen and L. Kovach, jun. (Proc. Amer. Soc. Test. Mat., 1935, **35**, II, 79—86).—Two methods of eliminating impurities other than Si and B are described. The first entails treatment with boiling HNO_3–HCl and conc. aq. NH_3, followed by heating in NH_3 and then in Cl_2 at 1000—1100°. The second method entails prolonged treatment with conc. HNO_3–HCl and with aq. NH_3. After either treatment the electrodes are burned with 10—15 amp. for 1·75 min. Ch. Abs. (e)

Colorimetry. E. K. Nikitin and V. I. Tichonova (J. Appl. Chem. Russ., 1938, **11**, 347—351).—The accuracy with which red colours may be compared is > that of yellow ones. The concn. of CrO_4'' may be determined by adding a ml. of fuchsin solution to the standard (concn. C), and then adding the same solution from a microburette to the unknown (concn. x) until the tone (but not intensity) of the colorations matches. The val. of x is then Cb/a, where b is the vol. of fuchsin added to the unknown. R. T.

Rapid photomicrography. W. Mutchler and H. O. Willier (Trans. Amer. Soc. Met., 1938, **26**, 279—288).—A method for making photomicrographs on a metallographic microscope is described. A special apparatus for holding roll film or photostat negative paper is substituted for the usual individually loaded film-holders. Focussing is carried out without removing the negative holder by means of a split light beam and an auxiliary eyepiece. A great saving in time is effected when large no. of specimens are to be photographed. R. B. C.

Construction and power of the ultra-microscope. B. von Borries and E. Ruska (Wiss. Veröff. Siemens-Werken, 1938, **17**, 99—106).—An instrument is described which in two stages yields magnifications up to 30,000 diameters, a beam of 80-kv. electrons being used as source of radiation. The definition obtained is ≫ can be obtained with light. It is suggested that the magnification could be increased still further by using improved magnetic lenses. J. W. S.

High-pressure mercury lamp as light source for ultramicroscopy. K. Hoffmann (Kolloid-Z., 1938, **83**, 9—13).—By greatly overloading an Osram high-pressure Hg lamp for short periods (about 0·1 sec.) the surface brightness can be increased to >250,000 candles. Experimental arrangements are described. Since this source is brighter than the sun and richer in small λλ, it is of special val. for making photo-ultramicrographs of liquid sols containing small particles in active Brownian movement, the optimum exposure time being 0·1 sec. Photographs are reproduced. F. L. U.

Micro-refractometer of simple design. A. E. Edwards and C. E. Otto (Ind. Eng. Chem. [Anal.], 1938, **10**, 225—226).—Details of construction are given. The instrument requires a vol. ~0·01 ml., and gives vals. of n agreeing with those given by a Pulfrich refractometer to within 0·3%. L. S. T.

New type of polarimeter. H. Takô (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 391—398).—The Nicol prisms of the ordinary polarimeter are replaced by Wollaston double prisms of quartz. Ordinary and extraordinary rays are separated by slits. The use of the instrument to investigate photo-elasticity and to measure optical rotations is described. T. H. G.

High resolving power tenfold thyratron counter. D. W. Kerst (Rev. Sci. Instr., 1938, **9**, 131—133).—The construction and calibration of a counter having a resolving time of 0·0005 sec. and using one pair of thyratrons to give the desired scale factor are described. N. M. B.

Radial expanding cloud chamber. F. Trey (Physikal. Z., 1938, **39**, 343—344).—The apparatus is described. A. J. M.

Demonstration electron diffraction tube. J. A. Darbyshire (J. Sci. Instr., 1938, **15**, 138).—A sealed-off cathode-ray tube has been constructed to give visible electron diffraction patterns at 7000 v. J. A. D.

Dew-point potentiometer for determining moisture content of gases.—See B., 1938, 467.

The differential dynamometer as an instrument for conductometric methods of analysis. I. Design and calibration. J. D. Parent and

C. A. CROWLEY. **II. Operational characteristics, technique, and use with certain reactions.** J. D. PARENT and R. J. MELCHIONE (Trans. Electrochem. Soc., 1938, **73**, Preprint 25, 353—365; Preprint 26, 367—378).—I. The a.c. instrument comprises a crossed moving-coil system and a pair of separately excited field coils. The two moving coils are respectively coupled to a variable rheostat and through a tapped transformer to the conductivity cell. The chief use of the instrument is in following the course of potentiometric titrations.

II. The direct-reading instrument is particularly adaptable to the conductometric titration of solutions the nature of which renders indicator methods unreliable. The accuracy normally attainable is approx. 1%. J. W. C.

Investigation of the lanthanum amalgam electrode for precise electromotive force measurements. W. G. PARKS and R. W. KINGERLEY (J. Physical Chem., 1938, **42**, 483—496).—The electrode potentials of saturated La amalgam in aq. $LaCl_3$ and $La_2(SO_4)_3$ and in solutions of $LaCl_3$ in EtOH, measured against a Ag–AgCl electrode, are irregular owing to changes in the p_H of the solution and H_2 overpotential. In C_5H_5N solutions AgCl was dissolved from the reference electrode and reacted with the Hg of the amalgam. Hence it is concluded that La amalgams are unsuitable for precise e.m.f. measurements. J. W. S.

Glass electrode. (MME.) C. ROY-POCHON (Compt. rend. XVII Cong. Chim. Ind., 1937, 445—447).—3 or 4 bulbs, each ~3 cm. in diameter, are blown in line in Corning 015 glass, and filled with the reference solution. Three of these units are fitted near to each other in the vessel containing the solution under examination. The surface of the electrode is thus increased, and the resistance reduced to 1 or 2 MΩ. The apparatus required for measurement can then be greatly simplified. L. S. T.

Cathode-ray oscillograph applied to the dropping mercury electrode. L. A. MATHESON and N. NICHOLS (Trans. Electrochem. Soc., 1938, **73**, Preprint 32, 433—447).—Good polarographic curves are obtained on the cathode-ray oscillograph by applying a relatively fast and rapidly recurrent voltage sweep (30 voltage sweeps per sec. from 0 to 2·5 v.) to the dropping Hg cathode (1 Hg drop per voltage sweep) in a solution. The sensitivity is almost equal to that of the slower Heyrovsky polarograph; advantages over the polarograph are discussed. E. S. H.

Absolute measurement of alternating currents and the calibration of thermocouples in the decimeter-wave range up to 500 megacycles per second. M. J. O. STRUTT and K. S. KNOL (Physica, 1938, **5**, 205—214).—An apparatus for calibrating thermocouples at frequencies $\geq$60 megacycles per sec., consisting of a diode voltmeter measuring the a.c. voltage developed across a known impedance, is described. Thermocouples calibrated with d.c. are accurate within 2% for these frequencies. A Scheibe hot-wire gas thermometer for use at frequencies up to 500 megacycles is also described; specially constructed d.c.-calibrated thermocouples are accurate to within 5% at 500 megacycles. A. J. E. W.

Measurements of small photo-electric currents by photo-conductive cells. M. KATO and C. ASAI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 278—285).—Photo-conductive cells have certain advantages over Cs_2O photo-emissive cells, *e.g.*, in infra-red sensitivity. Amplification of small photo-currents is considered, and a suitable amplifier and several photo-cells are described. Various uses of the cells are discussed. T. H. G.

Distance recorder for firedamp [in mine air]. —See B., 1938, 471.

Apparatus for micro-analysis of gases. T. C. SUTTON (J. Sci. Instr., 1938, **15**, 133—135).—An apparatus applicable to samples of 0·1 c.c. to 0·3 c.c. at n.t.p., and enabling all the reactions of macro-analysis to be applied to micro-analysis, is described. J. A. D.

Self-adjusting burette. L. A. YNALVEZ (Philippine Agric., 1937, **25**, 865—866).—A simple form of automatic adjustment of the zero meniscus is described. A. G. P.

Mechanised gas analysis apparatus. C. F. WINCHESTER (Rev. Sci. Instr., 1938, **9**, 134—138).—Mechanical devices for carrying out part of the routine work of gas analysis normally done by hand are described. Two sets each of CO_2 and O_2 apparatus are so arranged that duplicate determinations can be conducted simultaneously. N. M. B.

Study of chemical systems by measurement of variations of weight with regularly varying temperature. M. GUICHARD (Ann. Chim., 1938, [xi], **9**, 323—356).—Work previously published (A., 1925, ii, 427, 559; 1934, 1058; 1935, 599) is summarised and discussed. F. L. U.

Appliance for filtration, fractional crystallisation, and extraction at different temperatures. A. G. KULMAN (J. Appl. Chem. Russ., 1938, **11**, 557—560).—Apparatus is described. R. T.

Small portable air compressor for laboratory use. G. F. FLEMONS (Ind. Eng. Chem. [Anal.], 1938, **10**, 214). L. S. T.

Pump for circulation of gas. G. ARDITTI (Compt. rend. XVII Cong. Chim. Ind., 1937, 647—648).—An all-glass apparatus for the circulation of gases which do not attack Hg is described. The gas is circulated by means of Hg which, in turn, is operated by a piston. L. S. T.

Laboratory gas generator. V. S. TVERTZIN (J. Appl. Chem. Russ., 1938, **11**, 555—556).—Apparatus for generation of C_2H_4 from EtOH, which is dehydrated by passing over kaolin at 360—400°, is described. R. T.

Static method of determining vapour pressure. G. N. EVETZKI (J. Appl. Chem. Russ., 1938, **11**, 523—527).—A method is described. R. T.

Pendulum micro-manometer. R. MASEK (Z. Instrumkde., 1938, **58**, 121—122).—The portable micro-manometer described comprises a relatively wide reservoir and a narrow capillary tube of uniform bore bent into zig-zag form so as to give open-scale readings over the ranges 0·0—1, 1—10, 10—20, 20—40, and 40—100 mm. The manometer is suspended in a metal framework, and can be clamped and fitted

into a metal carrying case, through a window in which observations can be made. The instrument is suitable for use as a portable flowmeter. J. W. S.

Determination of the cross-section of molecules of soluble amphipathic substances. K. S. G. Doss (Current Sci., 1938, **6**, 446).—The method described gives 30×10^{-16} sq. cm. for the approx. cross-section of benzopurpurin 10B. L. S. T.

Procedure for micro-fusions. C. VAN BRUNT (Ind. Eng. Chem. [Anal.], 1938, **10**, 224).—A technique for the carbonate fusion of 0·1-mg. samples without loss by creeping employs Pt wire and ribbon. The method is unsuitable for pyrosulphate fusions. L. S. T.

Reflux bath agitator for low-temperature fractional distillation analysis columns. J. W. TOOKE (Ind. Eng. Chem. [Anal.], 1938, **10**, 214). L. S. T.

Distillation column. E. H. PARKE (J. Chem. Educ., 1938, **15**, 83). L. S. T.

Micro-separating apparatus. F. FABIAN (Mikrochim. Acta, 1938, **2**, 332).—The micro-separating funnel comprises a tube with its lower end terminating in a capillary tube (diameter 0·05—0·1 mm.) which is bent into an S-shape. The end of the capillary is drawn to a fine jet. The upper end of the tube is fitted with a ground jointed cap, through which air pressure may be applied to control the flow of liquid. No tap is used and hence losses are negligible. J. W. S.

Determination of azeotropic concentrations by the twin pyknometers method. M. WOJCIECHOWSKI (Nature, 1938, **141**, 691). L. S. T.

Approximate specific gravity determination. J. G. WAUGH (Ind. Eng. Chem. [Anal.], 1938, **10**, 209—211).—The method involves weighing the small object and determining its bouyancy by means of an apparatus resembling a hydrometer. For objects weighing 3 to 15 g. and d 0·33 to 0·95 the method is accurate to 0·01 unit. L. S. T.

Relative surface tension measuring device. F. B. QUINLAN (Rev. Sci. Instr., 1938, **9**, 140).—The improved capillary is prepared by spacing two glass rods or tubes with a wire wrapping around one of them, fusing the ends together, and removing the wire. The capillary is strong, easily cleaned, and offers an easy control of temp. of the capillary column. N. M. B.

Apparatus for etching Wollaston wire. B. F. BOARDMAN (Rev. Sci. Instr., 1938, **9**, 139—140).—An arrangement of tubes and three-way valves allows the lower soldered end of the wire to be surrounded by a protective liquid (CCl_4) on to which HNO_3 is run. Filling and washing can be carried out without disturbing the wire and normal difficulties are eliminated. N. M. B.

Platinisation of Nichrome and Nichrome-palladium. I. Method of preparation and applications. M. S. GERSCHENOVITSCH and N. Z. KOTELKOV (J. Appl. Chem. Russ., 1938, **11**, 253—256).—Ni-Cr wire or ribbon is oxidised at 800°, and covered with a layer of tincture consisting of 1 g. of $PtCl_2$ or $PdCl_2$ in 3 ml. of EtOH, 10 ml. of a saturated solution of H_3BO_3 in EtOH, and 20 ml. of a 1 : 1 turpentine–lavender oil mixture. After drying, the wire is heated at 800°, and the operation is repeated 2—3 times. The products thus obtained are highly active and stable catalysts, which may replace Pt- or Pd-asbestos, -porcelain, or -SiO_2, Pt- or Pd-black, or smooth Pt- or Pd-plated wires. R. T.

Automatic dipping mechanism for making built-up films. R. W. MATTOON and S. BERNSTEIN (Rev. Sci. Instr., 1938, **9**, 125—126).—The adjustable motor-driven mechanism described is used to build up films of 1000 or more mol. layers of Ba–Cu stearate by the Langmuir–Blodgett dipping technique (cf. A., 1937, I, 458). N. M. B.

Laboratory aids for analytical work. F. VON VIDITZ (Mikrochem. Acta, 1937, **2**, 209—213).—A const.-level device, a wash-bottle which limits the amount of liquid delivered, a soda-lime tube, and a Jena glass indicator bottle which minimises indicator changes due to alkali content of the glass and the action of light, are described and illustrated. C. R. H.

Ammonia-synthesis column for testing of catalysts.—See B., 1938, 508.

Apparatus for volumetric determination of carbon in ferrochromium and other alloys.—See B., 1938, 522.

Sodium press. E. H. PARKE (J. Chem. Educ., 1938, **15**, 93).—Details of a press constructed from steel and brass are given. L. S. T.

Conversion from weight- to mol-fraction. J. S. BAKER (Chem. Met. Eng., 1938, **45**, 155).—A graphical method for the conversion is described. D. K. M.

Gas absorber. P. S. CHEN (J. Chem. Educ., 1938, **15**, 145). L. S. T.

Method of research on the kinetics and mechanism of decomposition of individual hydrocarbons. A. DINTZES (J. Gen. Chem. Russ., 1938, **8**, 190).—Gas passed through a Cu tube immersed in molten Pb attains the temp. of the bath more rapidly than when a glass tube is used. R. T.

Dispersive liquids. G. AMIER (Compt. rend., 1938, **206**, 903—904).—Supercooled liquid mixtures of antipyrine with phenols possess high dispersive power (0·025—0·03) with low vals. of n_D (1·58—1·64), and a small variation of n with temp.; they are transparent to $\lambda\lambda$ < 3300—3600 A. Ba bromomercurate, Li iodoplumbate, and K iodobismuthate possess high dispersive power and low coeffs. of thermal expansion, and may be used for $\lambda\lambda$ < 3800, 4800, and 5800 A., respectively. A. J. E. W.

[Laboratory] experiment on heterogeneous equilibrium. A. A. VERNON (J. Chem. Educ., 1938, **15**, 88—89).—Details of the method for determining the phase diagram of the system p-$C_6H_4Me{\cdot}NH_2$–α-$C_{10}H_7{\cdot}OH$ are given. L. S. T.

Vestium. S. PLEŚNIEWICZ and K. SARNECKI (Przemysł Chem., 1938, **22**, 88—92).—Vestium, described by Śniadecki in 1808, is supposed to be identical with Ru. R. T.

"Nitre" and "natron." F. W. GIBBS (Ann. Sci., 1938, **3**, 213—216).—Historical.

Geochemistry.

Sulphur dioxide content of air at Boyce Thompson Institute. C. Setterstrom and P. W. Zimmerman (Contr. Boyce Thompson Inst., 1938, **9**, 171—178).—For the year Nov. 1913—Nov. 1937 the average SO_2 content, including zero readings, was 0·033 p.p.m. (max. 0·75 p.p.m.). Author.

Variations in the amount of water vapour in the air in the neighbourhood of Shanghai. P. Lejay (Compt. rend., 1938, **206**, 1065—1068).—Data, based on measurements of the transmission of the bands at λλ 1·469, 1·119, and 0·933 μ. in the solar spectrum, are recorded. H. J. E.

Measurements on the radon content of tap-water. G. J. Sizoo and C. P. Koene (Physica, 1938, **5**, 215—219).—With the apparatus described the Rn is boiled out from the H_2O, and transferred to one of two symmetrical ionisation chambers, the second of which provides compensation for background ionisation; the ionisation produced by the Rn is compared with that due to a standard source. Rn contents of 0·07—1·50 × 10^{-10} Curie per l. have been observed in 15 samples of tap-H_2O from different sources. A. J. E. W.

Physical and chemical studies in lakes of the Prince Albert Park, Saskatchewan. D. S. Rawson (J. Biol. Board Can., 1936, **2**, 227—284).—Data are recorded. Ch. Abs. (*e*)

Pink oil-well waters of the Ordzhonikidze oil field. N. A. Volodin (Azer. Neft. Choz., 1935, No. 6, 20—26).—Certain wells produce pink water, the colour of which is due to S bacteria. Ch. Abs. (*e*)

Oil-well waters of Cheleken Island. S. M. Lisitschkin (Neft, 1935, **6**, No. 19, 13—14).—Analytical data are given. Ch. Abs. (*e*)

Hydrogen sulphide and ferrous sulphide in the bottom deposits of the brackish water lake Hamanako, Sizuoka Prefecture. S. Yoshimura and T. Wada (Proc. Imp. Acad. Tokyo, 1938, **14**, 115—120).—The H_2S and FeS contents of the mud collected from places of different depths have been determined and correlated with the H_2S or O_2 content of the H_2O at the same level. Explanations of the observed variations with depth, temp., and with the time of the year are suggested as well as of the origin of the H_2S. T. H. G.

Ecology of the Tamar estuary. III. Salinity and temperature conditions in the lower estuary. A. Milne (J. Marine Biol. Assoc., 1938, **22**, 529—542).—Data showing the range and rate of fluctuation of salinity and temp. at various points on the bed of the lower Tamar estuary and in the overlying H_2O are recorded. L. S. T.

Geochemistry and total amount of sediments. P. H. Kuenen (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 302—303).—The formation of sediments is discussed. The total amount of weathered sediments is estimated at 8 × 10^8 cu. km., and the sediment from other causes >2 × 10^8 cu. km. The rate of sedimentation is: pre-Silurian 1 cm. in 5000 years; later, 1 cm. in 10,000 years; Globigerina ooze after the Tertiary, 1 cm. in 5000 years. A. J. E. W.

Gas evolution in the Tian-schan and Pamirs (geochemical characteristics). N. Prokopenko (Abh. Pamir Expedition 1930, Akad. Wiss. Leningrad, 1932, **1**, 15—35).—Analytical data for four types of gases recognised are recorded. Ch. Abs. (*e*)

Present trends in mineralogy. C. Palache (Bull. Geol. Soc. Amer., 1938, **49**, 447—460). L. S. T.

Leightonite, a new sulphate of copper from Chile. C. Palache (Amer. Min., 1938, **23**, 34—37). —*Leightonite* (I), $CuO,2CaO,K_2O,4SO_3,2H_2O$, triclinic, pseudo-orthorhombic, $a:b:c$ 0·7043 : 1 : 0·4578, α, β, γ near 90°, hardness 3, d 2·95, n_x 1·578, n_y 1·587, n_z 1·595, all ±0·002, occurs in pale blue prismatic crystals and in fibres filling cross-fibre veins at Chuquicamata. Chemical analyses are recorded. The chief associates are atacamite and kröhnkite, but never antlerite. (I) was formed only under conditions of low acidity. L. S. T.

Oxidised copper ores of the United Verde Extension mine. G. M. Schwartz (Econ. Geol., 1938, **33**, 21—33).—The ores of this deposit show an unusual amount of oxidation and secondary enrichment. The ore minerals and their paragenesis are described in detail. L. S. T.

Antofagastite and bandylite, two new copper minerals from Chile. C. Palache and W. F. Foshag (Amer. Min., 1938, **23**, 85—90).—*Antofagastite* (I), $2[CuCl_2,2H_2O]$, orthorhombic dipyramidal, space-group *Pbmn*, a_0 7·38, b_0 8·04, c_0 3·72 A., hardness 2·5, d 2·4, vitreous lustre, bluish-green, ω 1·646, β 1·685, γ 1·745, occurs in Calama, Antofagasta, Chile, as a crust on the surface of rock and quartz, with bandylite and atacamite (II). *Bandylite* (III), $CuB_2O_4,CuCl_2,4H_2O$, tetragonal holohedral, space-group *P4/nmm*, a_0 6·13, c_0 5·54 A., thick tabular, deep blue crystals, hardness 2·5, d 2·810, ω 1·692, ε 1·640, occurs in Calama, with (I) and (II) as a crust on rock joints. (III) is decomposed by H_2O leaving Cu borate as a residue. Chemical analyses of (I) and (III) are recorded. L. S. T.

Yttrialite from Iisaka, Japan. S. Hata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 455—459).—The olive-green mineral, d 4·31 (analysis: MgO 0·56, CaO 0·90, MnO 0·39, PbO 0·10, FeO 2·77, Al_2O_3 1·91, Ce earths 6·42, Y earths 44·70, TiO_2 0·05, ZrO_2 0·53, ThO_2 5·25, UO_2 3·72, SiO_2 29·91, H_2O+ 0·72, H_2O- 0·45, CO_2 0·50, F nil), is a Y diorthosilicate, $Y_2Si_2O_7$, with the Y partly replaced by Fe, Ca, Th, and U. Its age is 131 × 10^6 years. T. H. G.

Japanese thorogummite and its parent mineral. S. Iimori and S. Hata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 447—454).—A mineral, SiO_2 21·10, P_2O_5 1·77, $(Nb,Ta)_2O_5$ 0·40, ThO_2 25·05, Y earths 12·19, Ce earths 0·57, UO_2 7·91, ZrO_2 4·78, Fe_2O_3 8·67, Al_2O_3 2·22, BeO 0·40, CaO 0·95, MnO 0·35, $(As,Sb)_2O_3$ 0·32, H_2O 10·80, CO_2 3·01, PbO trace, approx. formula $(Th,U,Y,Fe)O_{2-1·5},SiO_2,2H_2O$, is described; it is considered to be a thorogummite.

Its radioactivity is 6 times that of Indian monazite. Enclosed in the thorogummite samples are cores of yttrialite and other minerals, the compositions of which change progressively. Hence it appears that yttrialite is the parent mineral of thorogummite. T. H. G.

Primary peridotite magma. H. H. Hess (Amer. J. Sci., 1938, [v], **35**, 321—344).—Field evidence showing that certain ultramafic rocks are the product of an ultramafic magma is presented. The origin of this magma is discussed. Such a magma is not incompatible with present knowledge of the system MgO–FeO–SiO_2. Numerous analyses are given. L. S. T.

Quartz monzonite and related rocks of the Libby Quadrangle, Montana, and the effects on them of deuteric processes. R. Gibson, I. Campbell, and W. F. Jenks (Amer. J. Sci., 1938, [v], **35**, 345—369).—The rocks described are mainly stocks intrusive into sedimentary formations of the Belt series in N.W. Montana. The chemical analysis of the principal stock, a quartz monzonite on Dry Creek, is recorded. Contact metamorphism and deuteric effects are described. L. S. T.

Occurrence of cristobalite in a sedimentary rock. D. S. Beljankin and V. P. Petrov (Amer. Min., 1938, **23**, 153—155).—An argillaceous sandstone from Nomanevi, Western Georgia, contains a considerable amount of cristobalite together with quartz. The mode of occurrence indicates its secondary origin by means of a gradual cristobalitisation of the primary quartz grains, a possibility that is discussed. L. S. T.

Gneiss and granites containing cordierite in the French Massif Central. H. Longchambon (Compt. rend., 1938, **206**, 846—849).—The relation of the deposits to neighbouring regions of granite and of gneiss containing sillimanite is discussed. A. J. E. W.

Genesis of the Quercy phosphorites. B. Gèze (Compt. rend., 1938, **206**, 759—761).—The nature and origin of the deposits are discussed. A. J. E. W.

Multiplicity of sulphide minerals and its causes. R. Schenck (Compt. rend. XVII Cong. Chim. Ind., 1937, 619—629).—The action of H_2 at const. temp. in the range 400—510° on mixtures of $Bi_2S_3 + Sb_2S_3$, $Ag_2S + Cu_2S$, $Ag_2S + PbS$, $Bi_2S_3 + Ag_2S$, $Ag_2S + BaS$, $Sb_2S_3 + Cu_2S$ in different proportions has been investigated, and the equilibria determined by a modification of Pélabon's method (A., 1902, ii, 253). The fractional desulphuration has revealed new condensed phases, either as complex combinations of the sulphides or as isomorphous mixtures. Many of these phases exist as minerals in nature. The multiplicity of these sulphide minerals is explained by chemical forces which have the nature of intermetallic forces; there is a strong analogy between certain of these sulphides and metallic alloys. The action of H_2 on the system Sb_2S_3–Ag_2S has given, besides the known phases, a new *compound*, $Ag_2Sb_4S_4$, which can form mixed crystals with Ag. L. S. T.

Iodine and bromine content of Solikhamsk carnallite, sylvinite, sylvine, and halite. S. K. Tschirkov (Kalii, 1937, No. 9, 21—28).—The relationship between the I and Br contents of sylvine and of halite in sylvinite is expressed by empirical mathematical equations. The distribution of Br in carnallite seams varies, but increases with the purity of the mineral. The quantity of Br present depends on the sequence of the carnallite layers. A curve is given showing the variation with depth of the Br content (0·15—0·25%) of Solikhamsk carnallites. With sylvinites the Br present increases with the sylvine content and falls progressively with the depth of the deposit. D. G.

Diffusion of iodine ions in the crystal structure of sylvine. S. K. Tschirkov (Kalii, 1937, No. 10, 35—38).—The distribution of I′ in a mass of sylvine crystals extracted from sylvinite is uneven, the [I′] increasing continuously from the centres of the crystals to the periphery. Apparently no diffusion of ions takes place in the crystal structure of an isomorphous mixture if the components of the latter have a crystal structure similar to that of NaCl. D. G.

Nitrate-free salt rocks from a Chilean salt-pan. W. Wetzel (Chem. Erde, 1938, **11**, 448—456).—Material from the Tarapacá desert consists of NaCl and sulphates (glauberite, thenardite, blödite, etc.). The suggestion is that these were deposited before the nitrates of the same region. L. J. S.

Analyses of rocks and minerals from the laboratory of the U.S. Geological Survey, 1914—1936. R. C. Wells (U.S. Geol. Survey, 1937, Bull. 878, pp. 134). L. S. T.

Economic geology of the northern Punjab, with notes on adjoining portions of the N.-W. Frontier Province. E. R. Gee (Trans. Min. Geol. Met. Inst. India, 1938, **33**, 263—354).—The occurrence, production, analyses, etc. of minerals of economic importance are described. L. S. T.

Recent mineral developments in the Copper River region, Alaska. F. H. Moffit (U.S. Geol. Survey 1937, Bull. 880-B, 97—107).—Production of Au from veins in the Bremner River Valley and the Nabesna mine, and placer operations in the Chistochina district and in Ahtell Creek are described. L. S. T.

Mineralogy of the granite-pegmatite along the river Lailjak. B. Gavrusevitsch (Abh. Pamir Expedition 1930, Petrol. Min. Akad. Wiss. Leningrad, 1932, **4**, 131—143).—The pegmatites are characterised by felspars, quartz, biotite, muscovite, lepidolite, gilbertite, almandite, tourmaline, pyrite, andalusite, dumortierite, and beryl (13·74% BeO). Ch. Abs. (*e*)

Geochemical-genetic types of pegmatite of the "Rechtsufers" (Pravobereschje) in the Ukraine. B. Gavrusevitsch (Trav. Inst. Lomonoss. Geochem. Acad. Sci. Leningrad, 1933, **2**, 23—69). Ch. Abs. (*e*)

New rare metal deposits in N.E. Kazakstan. I. Jagovkin and V. Gruza (Probl. Soviet Geol., Moscow, 1934, **9**, 62—72).—Quartz veins containing wolframite, scheelite, arsenopyrite, molybdenite, and Au accompany granite intrusions. Ch. Abs. (*e*)

Genesis of secondary mica in N. Karelia. S. Kurbatov (Trav. Inst. Lomonoss. Geochem. Acad. Sci. Leningrad, 1933, **2**, 89—101).—Secondary mica is

formed by the action of hydrothermal solutions rich in K_2O on plagioclase. The approx. formula of the secondary mica is $K_2O,4Al_2O_3,8SiO_2,3H_2O$.

CH. ABS. (e)

Olivine fourchites from Raymond Fosdick Mountains, Antarctica. C. N. FENNER (Bull. Geol. Soc. Amer., 1938, **49**, 367—400).—The actual course of crystallisation of the magma has been compared with that indicated by the theory of crystal fractionation, from chemical analyses (recorded) of the groundmass, the phenocrysts from the groundmass, and the constituent minerals of each, which in the case of these particular rocks have been able to be separated. The mineralogical make-up, structure, and texture of the specimens, which represent surface flows of basic lavas, together with fragmental tuffs, are described. The groundmass, freed from phenocrysts, has an ultrabasic composition, which leads to the conclusion that, contrary to inferences reached in the theory of crystal fractionation, wholly liquid magmas of ultrabasic composition exist. In passing from phenocrystic pyroxene to groundmass pyroxene there is a decrease of SiO_2 and MgO, large increases of Al_2O_3 and CaO, and a moderate increase of Fe oxides. These results are not in accord with those deduced from experimental work on silicate systems, the conditions of which are comparatively too simple to be applied to conditions obtaining in natural magmas. L. S. T.

Introduction of potash during regional metamorphism in W. New Hampshire. M. BILLINGS (Bull. Geol. Soc. Amer., 1938, **49**, 289—301).—Field observations and the chemical analyses recorded show that argillaceous sediments in this locality first recryst. to sillimanite schists without significant change in chemical composition, except loss of H_2O. In a later, metasomatic phase, K_2O was introduced, with a consequent increase in the K_2O–Al_2O_3 ratio. The chemical changes in this area are less extensive than, and differ in certain respects from, similar changes in the Stavanger region of Norway and in Dutchess Co., New York. L. S. T.

New exposures of Ordovician bentonite in S.W. Virginia. R. L. BATES (Science, 1938, **87**, 300).—Beds have been exposed at Turkey Cove, Lee County, Virginia. L. S. T.

Gold in the N.-W. Frontier Province. A. L. COULSON (Trans. Min. Geol. Met. Inst. India, 1937, **33**, 191—206).—Au washing operations with Indus sands and gravels in the Peshawar and Mardan districts and in Chitral are described and discussed. Sources of the Au are also discussed. L. S. T.

Late gold and some of its implications. J. B. MAWDSLEY (Econ. Geol., 1938, **33**, 194—210).—Examples of the late deposition of Au in Canadian deposits are described, and it is shown that, in some cases, deposition is much later than, and not closely related to, the associated minerals. The general tendency of valuable Au ore to occur in shoots within a vein can be explained by assuming that it is later than the bulk of the vein minerals and that its localisation is due to its following channels formed by late stresses after consolidation of the bulk of the vein. The Au may have its origin in liquid solutions derived directly from the magma residuum after long crystallisation. L. S. T.

Vein-filling at Nevada City, California. W. D. JOHNSTON, jun. (Bull. Geol. Soc. Amer., 1938, **49**, 23—33).—Complex veins in which deposition of quartz has alternated with movements of the vein walls are described. The four types of quartz structure are described and illustrated. The sulphide minerals present are enumerated. Altaite was the only telluride identified. L. S. T.

Weathering of Taunus quartzite. R. MELVILLE (Chem. Erde, 1938, **11**, 498—524).—Chemical analyses are given of the quartzite (SiO_2 92·66—98·16%) and derived sands and clay from several localities in the Taunus Mts., and of the portions sol. in HCl.

L. J. S.

Laramide igneous sequence and differentiation in the Front Range, Colorado. T. S. LOVERING and E. N. GODDARD (Bull. Geol. Soc. Amer., 1938, **49**, 35—68).—The general character and age relations of the Laramide igneous rocks are discussed. The magmatic differentiation of the porphyries is dealt with on physico-chemical lines. L. S. T.

New Zealand ironsand in relation to overseas deposits of titaniferous magnetite. A. W. WYLIE (New Zealand J. Sci. Tech., 1938, **19**, 572—584).—The composition of titaniferous Fe ores occurring in New Zealand is compared with those from various parts of the world. The extraction of V and Ti from such ores is described. A. G. P.

Mineral resources of the region around Boulder Dam. D. F. HEWETT, E. CALLAGAN, B. N. MOORE, T. B. NOLAN, W. W. RUBEY, and W. T. SCHALLER (U.S. Geol. Survey, 1936, Bull. 871, 197 pp.).—A summary of non-ferrous metal deposits (Au, Ag, Cu, Pb, and Zn); ferrous metal deposits of Fe ore, Mn, Co and Ni, Mo, W, and V; non-metalliferous resources, including salines*, borates, magnesite*, brucite, alunite*, alum, S, barytes, celestite* and strontianite, and beryl; constructional materials such as limestone, dolomite*, cement rock, and gypsum*; refractory and ceramic materials; fuels; and water. Analyses are recorded for minerals marked *.

L. S. T.

Geology and mineral resources of the Butler and Zelienople Quadrangles, Pennsylvania. G. B. RICHARDSON (U.S. Geol. Survey, 1936, Bull. 873, 93 pp.).—Stratigraphy and structure of the rocks, the coal (analyses given), oil and gas, shale and clay, sandstone, and limestone resources are described. Analyses of ground-H_2O and petroleum are recorded.

L. S. T.

Non-metallic mineral resources of eastern Oregon. B. N. MOORE (U.S. Geol. Survey, 1937, Bull. 875, 180 pp.).—The amphibole asbestos deposit on Pine Creek, Baker Co., and numerous deposits of diatomite, limestone, and pumice are described.

L. S. T.

Geology and mineral resources of the Baker Quadrangle, Oregon. J. GILLULY (U.S. Geol. Survey, 1937, Bull. 879, 119 pp.).—Numerous rocks, and the mineral resources of the area, which include deposits of Au, Ag, Cu, Mn, W, asbestos, coal, diatomite, and building stone, are described. L. S. T.

Regularities and anomalies in idocrase and some other lime silicates. R. GÄDEKE (Chem. Erde, 1938, **11**, 592—636).—New chemical analyses (19 in all) with optical data and ρ are given of idocrase (both normal and optically anomalous), prehnite, axinite, and garnet, and many others are tabulated from the literature. The results are plotted to show the variation of the physical characters with replacements Al–Fe^{III}, Si–Ti, H_2O–F, Mg–Fe^{II}, Fe^{II}–Mn, Ca–Mn, and Ca–Na. L. J. S.

Colouring of artificial and natural apatites. J. HOFFMANN (Chem. Erde, 1938, **11**, 552—575).—Fe^{III} and Fe^{II} together produce a green colour; Mn green or blue (not red). Some other colours are due to rare earths (cerapatite). Changes in colour produced by heat, light, and various radiations are described. L. J. S.

Influence of rare earths and other constituents on the physical-optical properties of the epidote group. H. G. TEMPEL (Chem. Erde, 1938, **11**, 525—551).—Several new chemical analyses and optical data of epidote and orthite from various localities are given, and some earlier results are tabulated and plotted. In epidote there is a linear increase in n, birefringence, and ρ with increasing Fe. In orthite, n and ρ increase, but less regularly, with increasing Fe and rare earths, and decrease with increasing H_2O. L. J. S.

Icelandic rocks. H. J. HOPPE (Chem. Erde, 1938, **11**, 457—479).—Petrographical descriptions with chemical analyses of basalts, tuffs, and obsidian collected in 1910 from the central part of Iceland are given. L. J. S.

Upper Cretaceous volcanicity in eastern Bulgaria. K. H. SCHEUMANN and A. SCHÜLLER (Tsch. Min. Petr. Mitt., 1938, **50**, 29—80).—Petrographical descriptions are given of rocks ranging from pyroxene-andesites to trachytes and latites. As all material collected is much propylitised, no chemical analyses were made. L. J. S.

Tafoni-weathering phenomenon. Petrographic contributions to the elucidation of Tafoni problems. I. KVELBERG (Latvij. Univ. Raksti, 1938, **4**, 129—370).—Numerous examples of a unique type of weathering, known as tafoni-weathering, occurring in Corsican granites, are described and discussed. The weathering is due not to chemical changes, but mainly to physical causes such as alterations in val. arising from temp. fluctuations. L. S. T.

Weathering of igneous rocks. V. Clay from basalt beds. M. HARADA (J. Agric. Chem. Soc. Japan, 1938, **14**, 450—458; cf. A., 1937, I, 538).—Analytical data for the clays (<0·002 mm.) from olivine basalt in Tottori and from nepheline and trachybasalt in Limane together with data for the HCl and H_2SO_4 extracts are given. 77—90% of the total Fe_2O_3 or 96—100% of the Fe_2O_3 sol. in HCl is present in the free form. SiO_2 is for the most part united with Al_2O_3. Clay from the upper earth is poorer in halloysite and richer in kaolin than that from lower earth. In comparison with fine earth (<2 mm.) clay from olivine basalt contains more kaolin, and that from nepheline basalt more halloysite. The ratio limonite-Fe_2O_3 : hæmatite-Fe_2O_3 for clay is > for fine soil. J. N. A.

Clay mineral (dickite) from Schmiedefeld, Thuringia. H. JUNG (Chem. Erde, 1938, **11**, 445—447).—Analysis of a compact white crust on Fe ore agrees with $Al_2O_3,2SiO_2,2H_2O$; ρ 2·600. The optical characters are not distinctive, but the low loss of H_2O (2·14%) at 500° and the X-ray pattern suggest dickite rather than kaolinite or nacrite. L. J. S.

Estonian blue clay. W. PRALOW (Chem. Erde, 1938, **11**, 480—497).—This is the oldest known clay (pre-Cambrian to Lower Cambrian). Mechanical and chemical analyses with microscopical and X-ray examination show it to consist of quartz, mica, montmorillonite, limonite, etc. The blue and green colour is attributed to pyrite (0·05—1·53%) and glauconite. L. J. S.

Geochemistry of the petroleum deposits of Forstort Brand at Nienhagen, Hannover. F. E. KLINGNER (Kali, 1938, **32**, 71—72).—The natural gas contains olefines 0·3—4·3, C_2H_6 etc. 2·2—17·1, CH_4 69·4—96·12, N_2 1·07—4·2%, and, in two analyses, traces of He. Analyses of the petroleum are represented on a triangular diagram. The brine-H_2O is poor in O_2 and contains 150 to 190 g. of salts per l., with 0·02 g. of I per kg. of residue. L. S. T.

Origins of petroleums; chemical and geochemical aspects. B. T. BROOKS (Bull. Amer. Soc. Petroleum Geol., 1936, **20**, 280—300).—A discussion. CH. ABS. (*e*)

Proportion of organic matter converted into oil in Santa Fe Springs field, California. P. D. TRASK (Bull. Amer. Assoc. Petroleum Geol., 1936, **20**, 245—257).—The oil is equiv. to a 1·8% yield of the org. content of the prism of sediments from which the oil is probably derived. CH. ABS. (*e*)

Eska Creek coal deposits, Matanuska Valley, Alaska. R. TUCK (U.S. Geol. Survey, 1937, Bull. 880-D, 185—211).—General occurrence of the deposits, character and analyses of the coal, mining operations, and coal exposures are described. L. S. T.

Geology and fuel resources of the southern part of the Oklahoma coal field. II. The Lehigh district, Coal, Atoka, and Pittsburg counties. M. M. KNECHTEL (U.S. Geol. Survey, 1937, Bull., 874-B, 91—149).—The occurrence of coal, analyses, and mining are described, and data concerning wells drilled for oil and gas in the Lehigh district are included. L. S. T.

Coal deposits of Pike County, Kentucky. C. B. HUNT, G. H. BRIGGS, jun., A. C. MUNYAN, and G. R. WESLEY (U.S. Geol. Survey, 1937, Bull. 876, 92 pp.).—Coal beds are described and analyses are recorded. L. S. T.

Thioelaterite. B. L. DUNICZ (Chem. Erde, 1938, **11**, 576—589).—A variety of elaterite with combined S from Bolivia contains C 82·27, H 12·35, N + O 1·69, S 2·96, ash 0·73%; ρ 0·989. Analyses are also given of the distillate, and portions extracted by various solvents. L. J. S.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JULY, 1938.

Sodium in the high atmosphere. R. BERNARD (Nature, 1938, **141**, 788).—Photographs of twilight spectra and the night sky spectrum, and interference photographs of the yellow radiation, prove the existence of Na in the high atm. L. S. T.

Intensities and displacements of interstellar lines. P. W. MERRILL and R. F. SANFORD (Astrophys. J., 1938, **87**, 118—132).—The intensity ratio of the D_2 line of Na to the K line of Ca is approx. 1·6, which indicates approx. three times as many atoms of singly-ionised Ca as of neutral Na. L. S. T.

Nuclear moment of aluminium. M. HEYDEN and R. RITSCHL (Z. Physik, 1938, **108**, 739—747).—Hyperfine structure measurements of some lines in the spark emission spectrum (Al II) give the nuclear spin of Al as 5/2, and the magnetic moment 3·7±0·3 nuclear magnetons (cf. A., 1937, I, 485). L. G. G.

Predissociation of sulphur. W. LOCHTE-HOLTGREVEN (Z. Physik, 1938, **109**, 147—149).—A reply to Olsson's remarks on the effect of pressure on the predissociation region (cf. A., 1938, I, 107). H. C. G.

Predissociation of sulphur. E. OLSSON (Z. Physik, 1938, **109**, 149; cf. preceding abstract).—Further discussion of the matter. H. C. G.

I II, I I, and Cl II spectra. K. MURAKAWA (Z. Physik, 1938, **109**, 162—174).—Identification and classification of the term schemes of I II, I I, and Cl II are given. L. G. G.

Hyperfine structure, Zeeman effect, and isotope shift in the resonance lines of potassium. D. A. JACKSON and H. KUHN (Proc. Roy. Soc., 1938, **A**, **165**, 303—312).—The intensity ratio of the components of the resonance lines of ^{39}K was measured by the method of absorption in an at. beam. The observed val. 1·45 agrees with that required by the spin, 3/2, if allowance is made for overlapping by the lines of the rarer isotope 41. The long-λ component is the stronger, showing that the nuclear magnetic moment of ^{39}K is positive. By use of three at. beams in series the lines of ^{41}K were resolved; its magnetic moment is also positive. The Zeeman effect was investigated and the observed positions of the lines were found to be in close agreement with those required by quantum theory. G. D. P.

Measurement of spectral intensities by comparison with total radiation. T. N. PANAY (Ann. Physique, 1938, [xi], **9**, 408—476).—The construction of an emitter of total radiation (a black body consisting of an electrically heated C tube in an atm. of A) for the measurement, by comparison, of the spectral intensity distribution of a no. of sources at various temp. is described. To obtain black bodies at fixed temp. the b.p. of metals are utilised. Results for the relative energy distribution of the continuous spectrum emitted by K in a flame are reported. The curve shows a min. for λ 5210 and a max. for λ 4430, with continuous decrease in the violet and ultra-violet. Total radiation in the visible and ultra-violet has been calc. for use with the Wien or Planck formulæ. A correction for the study of line spectra is given. N. M. B.

Equivalent widths and the temperature of the solar reversing layer. D. H. MENZEL, J. G. BAKER, and L. GOLDBERG (Astrophys. J., 1938, **87**, 81—101).—The mean excitation temp. of the solar reversing layer calc. from lines of Ti I. is 4400°±100°. L. S. T.

Spark spectrum of iron, 5016—7712 A., with identifications of Fe II lines in the solar spectrum. A. S. KING (Astrophys. J., 1938, **87**, 109—117).—The spectrum of Fe from a strong spark discharge gave 127 lines (λλ given) in the region >5000 A., due mainly to Fe II. The lines measured in the spark spectrum include some which are prominent in the spectra of novæ. L. S. T.

Action cross-sections for impacts of the second type in excited mercury vapour: hyperfine structure of the 2537 A. mercury resonance line. O. BUHL (Z. Physik, 1938, **109**, 180—203). L. G. G.

Optical investigation of a metal vapour discharge. V. Cumulative excitation of atoms in a low-pressure mercury discharge. V. FABRIKANT, F. BUTAEVA, and I. ZIRG (Physikal. Z. Soviet-union, 1938, **13**, 23—31; cf. A., 1937, I, 104, 158; 1938, I, 165).—The concn. of atoms in the $6^3P_{0,1,2}$ states during a discharge in Hg at a const. pressure of 10^{-3} mm. ∝ the electron concn. (c). In the excitation of the 7^3S_1 state the no. of cumulative excitations ∝ c^2. Reabsorption has a considerable effect on the increase in intensity of the individual lines with increasing current. J. W. S.

Improved description of the thorium spectrum. M. FRED (Astrophys. J., 1938, **87**, 176—197).—Part of the Th spectrum has been separated into approx. 750 Th I lines and 2000 Th II lines, the most important of which are tabulated. Certain of the lines of each spectrum are designated as low-temp. lines. The data are sufficient for the term analysis of Th I. L. S. T.

Ultra-violet absorption spectra of some early-type stars. W. S. ADAMS and T. DUNHAM, jun. (Astrophys. J., 1938, **87**, 102—108).—Measurements of absorption lines of two O-type and six B0- to B2-type stars are recorded for the region 3050—3400 A. Prominent elements are O II, O III, Si III, Si IV, S III, S IV, Ne II, He I, He II, and N II. L. S. T.

Very brilliant source of light. G. VAUDET (Ann. Physique, 1938, [xi], **9**, 645—722).—The production of a brilliant light of short duration by the explosion in air or vac. of a thin metal wire (Cu, Fe, Al, Zn, W) by a heavy current is described. The temp. may exceed 20,000°, and the duration of the light is $10—20 \times 10^{-6}$ sec. The spectrum of the light emitted, λλ 5000—1000, was studied. The presence of all possible ionised states was shown. An explanation of the formation of continuous spectra is offered, and applications of the method to the production of intense magnetic fields, the determination of the c.d. in a discharge, and the ultra-microscopy of rapidly moving particles and mols. are indicated. A. J. M.

Intensity of spectral lines in an arc with carbon electrodes. S. L. MANDELSTAM (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 559—563).—The effect of large amounts of NaCl or KCl on the intensities of the spectral lines of elements present in traces in the C arc is attributed to the lowering of the temp. of the arc. The effect is analysed with the aid of the Saha formula, and observed results are in qual. agreement with the theory. F. J. G.

Accuracy of the spin maintenance law. K. GAILER (Physikal. Z., 1938, **39**, 407—409).—An attempt has been made to test the electron spin maintenance law experimentally in the case of excitation by at. collision, the kinetic energy of the colliding atoms being considerably > their excitation energies. The collision of He with Be, Mg, Ca, and Sr atoms was investigated. In all cases triplet excitation of the alkaline-earth atoms was observed without simultaneous excitation of the He atoms. This appears to be contrary to the electron spin maintenance law, but may agree with it if metastable He atoms are present. A. J. M.

Effect of gases on the width and position of spectral lines. P. SCHULZ (Physikal. Z., 1938, **39**, 412—429).—A comprehensive review of theoretical and experimental work. A. J. M.

Possibility of measuring the transverse Döppler effect. O. SCHERZER (Ann. Physik, 1938, [v], **32**, 242—244).—Theoretical. H. C. G.

***g*-Values of *d*-electron-containing configurations of the rare gas terms.** K. LÖRINCZI (Z. Physik, 1938, **109**, 175—179).—*g*-Vals. of the p^5d terms are calc. from the energy matrices and compared with those obtained from observations on the Zeeman effect of certain A I and Kr I lines. L. G. G.

Behaviour of the frequency and polarisation of Stark effect components under sudden alteration of field conditions. R. GEBAUER (Z. Physik, 1938, **109**, 85—107).—The Stark effect with H_β and H_γ has been examined in rapidly changing fields. It is found that the time of observation exceeds a certain limiting val. for the effect to be observable. This result may be derived from the Heisenberg uncertainty principle. H. C. G.

Intensity ratios of Stark effect components of hydrogen lines. I. Intensity dissymmetry dependent on field strength. N. RYDE (Z. Physik, 1938, **109**, 108—120; cf. A., 1937, I, 485).—Intensity ratios of the Stark effect components of H_α and H_β have been examined by the canal ray method with field strengths up to 500 kv. per cm. The distribution of atoms among the different Stark effect levels is discussed. H. C. G.

Coefficient of volume ionisation for pure neon and neon-argon mixtures. I. I. GLOTOV (Physikal. Z. Sovietunion, 1938, **13**, 84—102; cf. A., 1938, I, 165).—The theoretical vol. ionisation coeffs. (α) for pure Ne and Ne–A mixtures are in qual. accord with experiments. The addition of $<5 \times 10^{-4}$% of A to Ne scarcely changes α, but additions $>5 \times 10^{-4}$% increase it many times, owing to increased ionisation of admixed atoms by metastable Ne atoms. When the [A] is >0·3% energy losses of electrons cause a decrease in the most probable electron velocity and hence a decrease of α. The results are applied to interpretation of observations on the Townsend discharge. J. W. S.

Sensitivity of the balanced space charge method for detecting ionisation of gases by collision of ions and atoms. (A) A. ROSTAGNI. (B) R. N. VARNEY (Physical Rev., 1938, [ii], **53**, 729—731, 732—734).—(A) Factors which influence the method are discussed critically with special reference to the results of Varney on A, Ne, and He (cf. A., 1935, 556; 1936, 1041).

(B) Additional information is given on the reaction of the detector to fast positive ions in the presence of gas in the tube. The sensitivity of the detector is analysed, primarily in terms of observations, and further notes on mechanism are given. N. M. B.

Application of transverse field methods to the measurement of ionisation and charging cross-sections. E. PERSICO and A. ROSTAGNI (Ann. Physik, 1938, [v], **32**, 245—252).—Conditions limiting the accuracy of the various methods employing transverse electric fields for the measurement of the ionisation and charging cross-sections of atoms and mols. are discussed. H. C. G.

Duration of counter tube impulses. J. M. LYSHEDE and J. C. MADSEN (Z. Physik, 1938, **108**, 777—779).—The forced quenching of counter tubes with rhythmically applied voltage impulses is used to study the duration of the tube discharge. It is shown that the tube potential must fall below a threshold val. and remain there for a definite time to cause quenching. This controls the max. no. of impulses recordable per sec. L. G. G.

Ion layer around a probe in a low-pressure discharge. V. POLIN and S. GVOSDOVER (Physikal. Z. Sovietunion, 1938, **13**, 47—54).—The density distribution of primary high-velocity electrons around an incandescent W filament acting as probe electrode in a Hg-vapour discharge has been studied. An

increase in the ionic current to the probe renders its ionic layer more symmetrical. J. W. S.

Dependence of the coefficient of the secondary emission on the angle of incidence of the primary beam. S. J. LUKJANOV (Physikal. Z. Sovietunion, 1938, **13**, 123—126; cf. J. Exp. Theor. Phys., 1937, **7**, 856).—The formula deduced previously is applicable to Müller's data (A., 1937, 1, 209). J. W. S.

Oxide-coated cathodes. I. Particle size and thermionic emission. M. BENJAMIN, R. J. HUCK, and R. O. JENKINS (Proc. Physical Soc., 1938, **50**, 345—357).—The emission from an oxide cathode increases as the particle size of the oxide decreases; the smaller particles give a more uniform emitting surface and increase the ratio of emitting to non-emitting areas. A tabulation of various methods of prep., with *X*-ray analysis of constitution and structure, shows that the size of the oxide particles is determined by the method of prep. of the carbonates. N. M. B.

Field electron emission at thin insulating layers of the Al–Al_2O_3–Cs_2O type. J. MÜHLENPFORDT (Z. Physik, 1938, **108**, 698—713).—Secondary emission at Al–Al_2O_3–Cs_2O cathodes in vac. may be excited by positive gas ions as well as fast electrons. The presence of inert gases at low pressure causes sp. variation in the type of emission, which is also temp.-dependent. L. G. G.

Electron liberation through impact of positive ions on the cathode in a glow discharge. II. Influence of cathode surface conditions. A. GÜNTHER-SCHULZE and H. BETZ. **III. Bends and breaks in the γ curves and their meaning.** A. GÜNTHER-SCHULZE and A. BÄR (Z. Physik, 1938, **108**, 780—785; **109**, 121—126; cf. A., 1938, I, 109).—II. The formation of films, especially oxide films, on cathodes of K, Mg, Al, Cu, Fe, Ag, and Pt has a pronounced effect on the liberation of electrons by impact of positive ions. With Mg at 2000 v. electron liberation is increased five-fold by formation of an oxide film. Formation of oxide or hydride films may be followed by this means.

III. Bends in γ curves (slope decreasing) have two causes. (1) At low cathode voltages emission arises from the oxide layer and is > that from the metal. As the voltage rises the oxide layer is removed by cathode sputtering, leaving bare metal. (2) At cathode voltages > ~ 3000 v. positive ions penetrate to the inner layers of the cathode and the liberated electrons fail to escape from the metal. H. C. G.

Motion of electrons in an alternating electric field. K. S. KNOL, M. J. O. STRUTT, and A. VAN DER ZIEL (Physica, 1938, **5**, 325—334).—In certain multigrid valves the application of suitable steady and alternating high-frequency potentials results in some electrons having a kinetic energy > corresponds with the instantaneous val. of the potential in their locality. An expression for this energy, calc. from the equations of motion, is discussed and applied to special cases. Comparison with experiment is satisfactory. A new way of rectifying high-frequency a.c. is described. T. H. G.

Theory of pressure-ionisation and its applications. D. S. KOTHARI (Proc. Roy. Soc., 1938, **A**, **165**, 486—500).—The theory predicts that the material in the interior of the white dwarf stars should be fully ionised and that there should be a max. radius (approx. that of planet Jupiter) for a body in which the electrons constitute a degenerate gas. The theory shows that Jupiter and Saturn have cores of metallic H. The planets Mercury, Venus, Earth, and Mars have cores of much heavier material, possibly Fe. G. D. P.

Formation of negative ions at surfaces. R. H. SLOANE and R. PRESS (Nature, 1938, **141**, 872—873).—Experiments showing that bombardment of metal surfaces with positive ions, presumably Hg^+, produces light negative ions possessing excess energy are described. A major cause of the production of these ions appears to be sputtering of persistently occluded electronegative films by bombardment with positive ions. L. S. T.

Transport of ions by a gaseous current. Expansion of an ionised gaseous current. (MME.) M. MOREAU-HANOT (Compt. rend., 1938, **206**, 1168—1170).—An expression is derived for the limiting current carried by a stream of gaseous ions moving with const. velocity through a tube of insulating material. Measured vals. are in approx. agreement, but decrease more rapidly than the calc. vals. with increasing tube length, and increase less rapidly with increasing velocity of the ion stream. A. J. E. W.

Formation of isotope $^5_2$He. F. JOLIOT and I. ZLOTOWSKI (Compt. rend., 1938, **206**, 17, 1256—1259; cf. A., 1938, I, 290).—Deuterons and protons were observed when a paraffin wax target was bombarded with α-particles. Energy calculations show that the protons are formed by $^4_2\text{He} + {}^2_1\text{H} \rightarrow {}^5_2\text{He} + {}^1_1\text{H} + Q$. The $^5_2$He nucleus is stable with respect to neutron emission. Natural sources of He contain very little $^5_2$He. J. A. D.

Isotopic constitution of gadolinium, dysprosium, erbium, and ytterbium. A. J. DEMPSTER (Physical Rev., 1938, [ii], **53**, 727—728).—The mass spectra photographed by the use of a spark source for the ions reveal the following new isotopes with their approx. % abundance: ^{154}Gd (1·5), ^{152}Gd (0·2), ^{160}Dy (1·5), ^{158}Dy (0·1), ^{164}Er (2), ^{162}Er (0·25), ^{170}Yb (2) ^{168}Yb (0·06) (cf. Pool, A., 1938, 1, 291). N. M. B.

Eighth report of the Atomic Weight Commission of the International Union for Chemistry. G. P. BAXTER, O. HÖNIGSCHMID, and P. LEBEAU (Ber., 1938, **71**, [*A*], 93—105).—The report covers the period from 30th September, 1936, to 30th September, 1937. The following changes are recommended: H, 1·0078 to 1·0081; He, 4·002 to 4·003; C, 12·01 to 12·010; Mo, 96·0 to 95·95; Er, 167·64 to 167·2; W, 184·0 to 183·92; Os, 191·5 to 192. H. W.

Energy–range relations for deuterons, protons, and α-particles. F. T. ROGERS, jun., and (MRS.) M. M. ROGERS (Physical Rev., 1938, [ii], **53**, 713—714).—Complete available data (Bethe, A., 1938, I, 172) are presented as a set of 11 equations. N. M. B.

Form of the β-spectrum of Ra-*E* in the vicinity of the upper limit and the mass of the neutrino. A. I. ALICHANIAN, A. I. ALICHANOV, and B. S. DJELEPOV (Physical Rev., 1938, [ii], **53**, 766—767; cf. A., 1938, I, 168).—Using the method of electron focussing in a uniform magnetic field, the spectrum was investigated near the upper limit. Results and curves obtained from the Konopinski–Uhlenbeck theory are given, and satisfactory agreement is obtained (cf. Lyman, A., 1937, I, 107). N. M. B.

Shape of the β-spectrum of Th-*C* and the mass of the neutrino. A. I. ALICHANIAN and S. J. NIKITIN (Physical Rev., 1938, [ii], **53**, 767; cf. preceding abstract).—The shape of the spectrum, investigated by the magnetic focussing method, is similar to that of Ra-*E*, and is in close agreement throughout with the Konopinski–Uhlenbeck curve. N. M. B.

Directional distribution of β-ray processes. I. I. PREDMESTNIKOV (Physikal. Z. Sovietunion, 1938, **13**, 32—35).—Mathematical. J. W. S.

β-Spectrum of radioactive substances. E. F. M. VAN DER HELD (Physica, 1938, **5**, 430—432).—Neither the theory of Fermi nor that of Konopinski and Uhlenbeck on the energy distribution in the β-spectrum agrees perfectly with experimental results but a linear combination of the two should and apparently does agree much better. Two such linear expressions are deduced; the gradient of the first $\propto$ at. no., while the second intersects the W-axis at the same point as Kurie's function $\sqrt{N/f}$. T. H. G.

Absorption and diffusion of β-rays in cellulose acetate. R. ARNOULT (J. Phys. Radium, 1938, [vii], **9**, 145—148).—The absorption curves of electrons from active thoron in cellulose acetate have been measured, with the use of a magnetic focussing method to obtain beams of uniform energy. O. D. S.

Absorption of β-rays of radioactive elements. M. E. NAHMIAS and L. I. SCHIFF (J. Phys. Radium, 1938, [vii], **9**, 140—144).—An exact method for the measurement of the absorption curves of β-rays has been developed and gives vals. for the max. energy of the β-rays agreeing with those obtained by other methods. A γ-radiation with energy of the order 100 e.kv. accompanies the β-emission of radioactive Ag (22 sec.) to the extent of $>$ 10 quanta per β-particle emitted. O. D. S.

γ-Ray activity induced in cadmium by slow neutron bombardment. S. NAKAGAWA and I. SUMOTO (Proc. Imp. Acad., Tokyo, 1938, **14**, 106—107).—Cd has been bombarded, both directly and in a paraffin block, by neutrons from Rn–Be and Be + D. In addition to the usual β-ray activity, γ-ray activity has been observed and suggests that there is produced a Cd isotope of 45 min. period which emits fairly strong γ-rays of energy 10^6 e.v., but very weak or no β-rays. Ag and Mo filters showed no selective absorption indicative of K radiation from an element such as Ag. T. H. G.

Production of gamma-rays by neutrons. E. H. S. BURHOP, R. D. HILL, and A. A. TOWNSEND (Proc. Roy. Soc., 1938, **A**, **165**, 116—132).—Curves of absorption in B of those neutrons which excite γ-rays in Ag, Cd, As, Sb, I, and Hg are experimentally investigated. For non-thermal neutrons the curves are interpreted in two parts: (i) associated with a nuclear resonance level corresponding with a very small neutron energy, (ii) due to neutrons captured into resonance levels of greater energy. Additional measurements on Ag were made for those neutrons which excite β-radiations. The identity of the energy levels which give rise to γ- and to β-radiation in the same nucleus is discussed. G. D. P.

Emission of an ionising radiation by dried vegetable matter. F. ARTIGAS (Compt. rend., 1938, **206**, 1200—1202; cf. A., 1938, I, 112).—Radioactivity due to K has been detected in tobacco, and in dried colza flowers and parsnip foliage. A. J. E. W.

Uranium-*Z* and the problem of nuclear isomerism. N. FEATHER and E. BRETSCHER (Proc. Roy. Soc., 1938, **A**, **165**, 530—551).—The radiations from U-Z have been examined by the absorption method using a tube counter. A scheme of energy levels is put forward to account for the facts and the isomerism of the nuclei U-X_2 and U-Z is discussed. It is concluded that U-Z is formed from U-X_2 in a β–γ branching, rather than from U-X_1 directly in a β–β transformation. G. D. P.

Energy and intensity of photoneutrons from beryllium and from the deuteron. H. VON HALBAN, jun. (Compt. rend., 1938, **206**, 1170—1172).—Production of neutrons by bombardment of D and Be by γ-rays from radio-Th and Ra has been investigated. The effective cross-sections for γ-rays of 2·64 Mev. energy from radio-Th are: D, $10 \pm 0{\cdot}8 \times 10^{-28}$; Be, $3{\cdot}1 \pm 0{\cdot}4 \times 10^{-28}$ sq. cm. The intensity distributions of the neutrons obtained using the radio-Th and Ra γ-ray sources are identical, indicating that Ra emits γ-rays of approx. energy 2·6 Mev. Ra–Be sources produce neutrons of widely varying energy. The proportions of Ra and radio-Th in MsTh may be determined from the neutron yields with D and Be. Be in alloys may be determined similarly, using a Ra or radio-Th source. A. J. E. W.

Scattering of slow neutrons in a crystal lattice. I. POMERANTSCHUK (Physikal. Z. Sovietunion, 1938, **13**, 65—83).—Mathematical. J. W. S.

Fast neutrons. M. L. POOL (Physical Rev., 1938, [ii], **53**, 707—710).—The distribution of fast neutrons about the Li + D source, investigated by means of radioactivity induced in Ag (24·5 min.) and Al (14·8 hr.), is roughly in agreement with that calc. from statistical considerations. The max. neutron energy is 20·8 M.e.v. Sources and energies of neutrons producing various reactions are examined. N. M. B.

Magnetic properties of free neutrons. O. R. FRISCH, H. VON HALBAN, jun., and J. KOCH (Physical Rev., 1938, [ii], **53**, 719—726).—A detailed account of results previously reported (cf. A., 1937, I, 340, 441, 543). Investigations indicate that the magnetic moment of the neutron is approx. $2 \times 1/1840$ Bohr magneton and the sign is negative. The field accounting for the observed rate of precession of neutrons inside magnetised Fe is $>$100 times the actual

field strength H and actually of the order of magnitude of the magnetic induction B. N. M. B.

Formation of an excited ^{3}He in the disintegration of deuterium by deuterons. T. W. BONNER (Physical Rev., 1938, [ii], **53**, 711—713; cf. A., 1938, I, 6).—Observation of the energy distribution of the neutrons from the reaction $^2H + {}^2H \rightarrow {}^3He + n' + Q_1$ shows two homogeneous neutron groups with energies 1·08 and 2·50 M.e.v. at 90° to the 0·11 M.e.v. deuterons. The probability ratio is 1 : 10. The corresponding vals. of Q_1 are $3·29 \pm 0·08$ and $1·40 \pm 0·11$ M.e.v. The low-energy group results when the ^{3}He is left excited to a level of $1·89 \pm 0·11$ M.e.v. The mass of ^{3}He, calc. from the val. of Q_1 and the mass-spectrographic val. of $^2H = 2·01473$, is 3·01700, indicating that ^{3}H may disintegrate spontaneously into ^{3}He with emission of an electron. N. M. B.

Identification and measurement of helium formed in beryllium by γ-rays. E. GLÜCKAUF and F. A. PANETH (Proc. Roy. Soc., 1938, **A**, **165**, 229—238).—A microchemical method for the determination of He in Be is described. It is concluded that the disintegration product of Be, which emits neutrons when irradiated by γ-rays, is two atoms of He and not the isotope of Be of mass 8. G. D. P.

Occurrence of helium in beryls. J. W. J. FAY, E. GLÜCKAUF, and F. A. PANETH (Proc. Roy. Soc., 1938, **A**, **165**, 238—246; cf. preceding abstract).—Various specimens of old Be metal have been analysed for He. It is concluded that the spontaneous production of He is $< 1·3 \times 10^{-11}$ c.c. per g. per year. It follows that the He content of beryls cannot be due to disintegration of ^{8}Be, nor can it be ascribed to the influence of natural sources of γ-rays. As Be does not itself produce adequate amounts, the He content of beryls must be ascribed to some other element. G. D. P.

Deuteron-induced radioactivity in oxygen. T. YASAKI and S. WATANABE (Nature, 1938, **141**, 787).—Bombardment of O_2 and several oxides (CO_2, WO_3, and H_2O) with 2 M.e.v. deuterons gives ^{17}F with a period of 1·5 min., and ^{18}F with one of 120 min. The upper limit of the energy of the positrons emitted from the latter isotope is $0·7 \pm 0·05$ M.e.v. Possible nuclear reactions by which it may be formed are discussed. L. S. T.

Artificial activity of radio-aluminium (^{26}Al) and radio-chlorine (^{34}Cl). H. BRANDT (Z. Physik, 1938, **108**, 726—738).—A theoretical and practical study of the production of $^{26}_{13}$Al and $^{34}_{17}$Cl by α-particle bombardment of Na and P. L. G. G.

Preparation of radio-element $^{32}_{15}$P in weighable quantity by means of an electric field. J. GOVAERTS (Nature, 1938, **141**, 871).—By irradiation of CS_2 for 9 days with neutrons from a Ra + Be source in presence of an electric field of 70—90 v. the $^{32}_{15}$P produced is conc. almost entirely on the brass or Cu anode, which is covered with a black deposit of phosphide (?); the increase in wt. was 3·7 mg. L. S. T.

Radio isotopes of nickel. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], **53**, 765).—Ni bombarded for 4 hr. by 100 μamp. of 5·5 M.e.v. deuterons yields ^{63}Ni ($2·6 \pm 0·03$ hr.) emitting negative electrons and γ-rays; ^{61}Cu is also produced (cf. Thornton, A., 1937, I, 439). Fe exposed to several μamp.-hr. of bombardment with He ions at 12·6 and at 16 M.e.v. gives rise to ^{57}Ni, a new isotope of half-life 36 ± 2 hr., emitting positrons and a γ-ray, probably annihilation radiation. N. M. B.

Concentration of radioactive copper by use of a high-speed rotating cathode. J. STEIGMAN (Physical Rev., 1938, [ii], **53**, 771).—The prep. of radioactive Cu (12·8 hr.) and its separation from solution by means of a high-speed rotating cathode are described, and operating conditions discussed. High concn. is obtained without the necessity of adding an inactive isotope as a carrier. N. M. B.

Artificial radioactivity produced by protons. L. N. RIDENOUR, L. A. DELSASSO, M. G. WHITE, and R. SHERR (Physical Rev., 1938, [ii], **53**, 770).—Ni, Cu, Mg, and Ag became strongly radioactive after bombardment with about 1 μamp. of protons at 3·8 M.e.v., accelerated by a cyclotron. Ni gave four periods: 80 ± 2 sec., $7·9 \pm 0·6$ min., $3·4 \pm 0·1$ hr., and $12·8 \pm 0·3$ hr.; the relative intensities and probable interpretations are 3 : 1 : 31 : 35, and ^{58}Cu, ^{60}Cu, ^{61}Cu, ^{64}Cu, respectively. Each of the first three emits positrons, and ^{64}Cu emits electrons and positrons. Cu gives rise to ^{63}Zn of half-life 38 ± 1 min., emitting positrons. Mg gives ^{24}Al or ^{25}Al (20 ± 2 min.) emitting positrons; there is also a weaker unidentified activity of some hr. half-life. Ag gives a weak activity of a few min. half-life, and a strong activity, ^{107}Cd or ^{109}Cd ($6·67 \pm 0·06$ hr.), emitting electrons which are provisionally regarded, not as disintegration electrons, but as photo-electrons ejected by a γ-radiation which follows extranuclear electron capture by the unstable Cd isotope. A weak radiation is probably Ag $K\alpha$ radiation, the production of which is interpreted. N. M. B.

Artificially radioactive arsenic. P. HARTECK, F. KNAUER, and W. SCHAEFFER (Z. Physik, 1938, **109**, 153—161).—The β-decay of radioactive As, deposited on thin Al foil, was measured by photographing a large no. of tracks in an automatic Wilson chamber. Energy distribution was obtained by application of a magnetic field to the tracks, and the β-spectrum yields two components of limiting energies $3·16 \pm 0·10$ M.e.v. and $1·10 \pm 0·20$ M.e.v. The significance of these is discussed and a term scheme for $^{76}_{34}$Se is derived. L. G. G.

Isomeric forms of radio-rhodium. B. PONTECORVO (Nature, 1938, **141**, 785—786).—The ratio of the initial intensities of the radioactive forms of Rh with periods of 44 sec. and 4·2 min., obtained by bombardment of Rh with neutrons, have been deduced from the total activity (i) with a source of Rn + Be in presence of paraffin; (ii) with Rn + Be placed on the axis of the cylinder of Rh in absence of paraffin and H media. The vals. are $11 \pm 0·7$ and $6 \pm 0·5$, respectively. L. S. T.

New radioactive silver isotope with long half-life period. H. REDDEMANN and F. STRASSMANN (Naturwiss., 1938, **26**, 187—188).—In addition to the Ag isotopes with half-life 2·3 min. and 23 sec., re-

spectively, four others with half-life periods 24·5 min., 8·2 days, 7·5 days, and 3·2 hr. have been discovered. ^{106}Ag occurs in two isomeric forms, one of which loses a positron and has a half-life period of 24·5 min. whilst the other loses an electron, and has a half-life of 8·2 days. Both are obtained by irradiation of Ag with rapid neutrons (Li + D), the process being ^{107}Ag $(n, 2n)$ ^{106}Ag, and by bombardment with Ra–Be neutrons. Long irradiation with slow Ra–Be neutrons gives rise to a further isotope (an isomeride of ^{108}Ag or ^{110}Ag) with a half-life of 190±40 days. A. J. M.

Long-period radioactivity in silver, cæsium, and indium activated by slow neutron bombardment. K. ALEXEEVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 553—555).—Ag, Cs, and In, after bombardment with slow neutrons, exhibit radioactivity with half-life periods of 1·5—2 years, < 1 year, and 60±10 days, respectively. F. J. G.

Heavy electrons and theories of nuclear processes. G. WENTZEL (Naturwiss., 1938, **26**, 273—279).—Arguments in favour of the existence of heavy electrons based on the consideration of the penetrating component of cosmic radiation, proton–neutron force, and β-disintegration are reviewed. The theory of Yukawa and the phenomenon of showers are also dealt with. A. J. M.

Heavy electrons in cosmic rays. E. J. WILLIAMS and E. PICKUP (Nature, 1938, **141**, 836).—A correction (cf. A., 1938, I, 291). L. S. T.

New analysis of cosmic radiation including the hard component. L. W. NORDHEIM (Physical Rev., 1938, [ii], **53**, 694—706).—A representation of all known data on cosmic-ray intensities in their dependence on geomagnetic latitude and on altitude (and depth below sea level) is obtained on the assumption of hard and soft components with specified properties. N. M. B.

Nature of the penetrating component of cosmic rays. P. M. S. BLACKETT (Proc. Roy. Soc., 1938, **A, 165**, 11—31).—Measurement of the energy loss in plates of Pb and Au shows that most rays with $E < 2 \times 10^8$ e.v. are apparently electronic in character. From a reinterpretation of the data for higher energies it is concluded that the penetrating rays are not normal electrons. Two theories are discussed to explain the facts. In one it is postulated that the particles change their mass during collisions with nuclear fields; in the other, penetrating rays are supposed to have electronic rest mass, but are distinguishable from normal electrons by a property which has the effect of making their radiative energy loss vary with their energy. G. D. P.

Scattering of cosmic-ray particles in metal plates. P. M. S. BLACKETT and J. G. WILSON (Proc. Roy. Soc., 1938, **A, 165**, 209—215).—Multiple scattering is measured in Pb and Cu plates, the vals. of $H\rho$ extending from 10^5 to 3×10^7 gauss-cm. The scattering angle is inversely $\propto H\rho$ and is in approx. agreement with theory. The results support the view that it is by their greater rest mass that the penetrating rays are distinguished from radiating electrons. G. D. P.

Cosmic rays; barometric effect, variations of the second kind, and disturbances produced by the earth's magnetic field. W. KOLHÖRSTER (Physical Rev., 1938, [ii], **53**, 768—769).—Records for January, 1938, are plotted and discussed. N. M. B.

Rate of production of very large cosmic-ray bursts as a function of lead shielding thickness. W. P. JESSE and R. L. DOAN (Physical Rev., 1938, [ii], **53**, 691—693).—Determinations of the frequency of occurrence of very large bursts (120—>1000 particles) as a function of Pb shielding thickness showed that the thickness of Pb for optimum burst rate was approx. 3 em. N. M. B.

Magnetic determination of the energy of cosmic-ray particles. H. D. RATHGEBER (Z. Physik, 1938, **109**, 273—292).—The deviation of the path of cosmic-ray particles by means of a magnetic field in air is studied. A new type of electromagnet is described giving a strong field, well spread out, and capable of producing deviations of ~ 1 cm. L. G. G.

Periodic system of the elements. E. C. PAYNE (J. Chem. Educ., 1938, **15**, 180—183).—An octagonal prism is divided into rhombs by a descending helical band and an element is assigned to each rhomb. L. S. T.

Atomic volumes. R. LAUTIÉ (Bull. Soc. chim., 1938, [v], **5**, 695—701).—The most abundant isotope of an element generally contains an even no. of protons (P) in the atom, the only exceptions being ^{9}Be, ^{14}N, and perhaps ^{129}Xe and ^{195}Pt. With the exception of H, which contains no free neutrons, the no. of neutrons (N) lies within the limits $P \gtrsim N < 2P$. It is deduced that for elements of the same family in the same cryst. state the at. vols. are given approx. by $V = an^3/P + b$, where n is the order of the element in the series and a and b are consts. Calc. vals. of V are in accord with experiment, except in the case of He (cf. A., 1937, I, 349). Since crystal parameters of the elements of the same family are a linear function of the cube root of the parachor [P], it is inferred that [P] is not $\propto V$, but that $[P]^{\frac{1}{3}}$ is a linear function of $V^{\frac{1}{3}}$. Combined data on the Carlsohn groups permit a revision of the periodic classification. J. W. S.

Magnitude of nuclear forces. G. BECK (Nature, 1938, **141**, 832; cf. A., 1938, I, 292).—The interaction const. between heavy particle and heavy electron field is $[(hc/2\pi)(2m/M)]^{\frac{1}{2}}$. L. S. T

Neutrino theory of light. II. Three-dimensional case. A. SOKOLOV (Physikal. Z. Sovietunion, 1938, **13**, 36—46; cf. A., 1937, I, 441).—Mathematical. J. W. S.

Fundamental unit of electric charge. H. T. FLINT and W. WILSON (Proc. Physical Soc., 1938, **50**, 340—344).—Mathematical. A generalisation of the uncertainty relationships when an electromagnetic field is present. The atomicity of electric charge is a consequence of the integral relationships of the quantum theory. N. M. B.

Eddington's fundamental equation. H. C. CORBEN (Nature, 1938, **141**, 747). L. S. T.

Effects of electron interaction on energy levels of electrons in metals. E. WIGNER (Trans. Faraday Soc., 1938, **34**, 678—685).—A theoretical discussion. F. L. U.

Potential in the new electrodynamics. Z. CHRAPŁYWY (Bull. Acad. Polonaise, 1937, **A**, 509—520; cf. Meixner, A., 1935, 1050).—Mathematical. The shift in energy levels due to insertion in the wave equation of the potential expression obtained from the Born–Infeld field theory does not remove the discrepancy between theory and experiment in the H spectrum. I. McA.

Universal constant for band spectra. Attribution of lines in a band to causes other than rotation of the molecule. H. DESLANDRES (Compt. rend., 1938, **206**, 1153—1157).—The application of the formula $\nu = qd_1/s'r'$ (cf. A., 1938, I, 115) to lines hitherto supposed to have vibrational or rotational origin is discussed. Vibrational lines are attributed to interaction between the electrons of one atom or radical with the nucleus of the second, and rotational lines to interactions between the electrons of the two atoms or radicals concerned. The νν of a no. of lines in the spectra of H_2O, HCl, NH_3, CO, CaF_2, and H_2 are shown to be in agreement with the above formula. The results indicate that the electrons in an atom are not excited in succession, all the electrons in one level or sub-level being simultaneously excited. A. J. E. W.

Life time of free CN radical. J. U. WHITE (J. Chem. Physics, 1938, **6**, 294).—The 0,0 band of the $^2\Sigma \rightarrow {}^2\Sigma$ system of the CN radical at 3883 A. has been observed by a method which is described. The longest life observed was 0·006 sec. W. R. A.

Rotational analysis of bands of lead sulphide. H. BELL and A. HARVEY (Proc. Physical Soc., 1938, **50**, 427—435).—Full data are tabulated, with analyses, of the (6,0), (7,0), (9,0), (2,1), (3,1), and (4,1) bands of the $A \leftarrow X$ system of ^{208}PbS in absorption, and consts. are evaluated. A no. of lines due to ^{206}PbS and ^{207}PbS are recorded. N. M. B.

Band spectrum of tin monoxide. II. P. C. MAHANTI and A. K. SEN GUPTA (Z. Physik, 1938, **109**, 39—51).—An analysis of the 1,0, 0,0, and 0,1 bands ($\lambda\lambda$ = 3323·5, 3388·2, and 3484·4, respectively) corresponding with a $^1\Sigma \rightarrow {}^1\Sigma$ transition of the A system of SnO is given. The lower state is the ground state of the mol., viz., Sn (^3P) and O (^3P). The rotation lines of the 0,1 band are split into three components and provide a quant. estimation of the Sn isotope effect. (Cf. A., 1931, 544.) L. G. G.

Band spectrum of silicon monosulphide. R. F. BARROW and W. JEVONS (Nature, 1938, **141**, 833).—A system of 70 to 80 bands, degraded to the red, has been observed in the region 2576—3876 A. when heavy-current discharges are passed through a mixture of SiS vapour and A. The rotational structure of the stronger bands appears to be that given by $a^1\Pi \rightarrow {}^1\Sigma$ transition. The SiS discharge also shows 70 to 80 bands, extending from 3491 to 6169 A., which are similar in appearance and distribution to bands in the longer λ sequences of the above system. The emitter may be SiS. The ultra-violet system of SiS is well developed also in a heavy-current discharge through Al_2S_3 vapour in a SiO_2 tube. L. S. T.

Rotation analysis of the $a^3\Pi \rightarrow X^1\Sigma$, $c^3\Sigma^+ \rightarrow a^3\Pi$, and $a'^3\Sigma^+ \rightarrow a^3\Pi$ band systems of carbon monoxide. L. GERÖ (Z. Physik, 1938, **109**, 204—209, 210—215, 216—222). L. G. G.

Predissociation in the CO spectrum at 8·83 volts. R. SCHMID and L. GERÖ (Physikal. Z., 1938, **39**, 460—462).—Predissociation at the end state of the Angström bands of CO for the $A^1\pi$ state has been observed; the energy being 8·83 v. This is confirmed by the absorption determinations of Hopfield *et al.* The dissociation scheme of CO has been more closely investigated. A. J. M.

Absorption spectra of sulphur dioxide and carbon disulphide in the vacuum ultra-violet. W. C. PRICE and (MISS) D. M. SIMPSON (Proc. Roy. Soc., 1938, **A**, **165**, 272—291).—The spectra have been investigated down to 1000 A.; the bands can be divided into two classes which exhibit (i) wide vibrational structure, (ii) little or no vibrational structure. Ionisation potentials of the mols. are evaluated and some general features of electronic spectra of polyat. mols. are discussed. G. D. P.

Calcium subfluoride. K. H. HELLWEGE (Z. physikal. Chem., 1938, **B**, **39**, 465—470).—The predissociation spectrum of CaF shows that this mol. dissociates to give an excited Ca atom. The following heats of reaction were deduced: $CaF + F = CaF_2 +$ 285 kg.-cal; $2CaF = CaF_2 + Ca +$ 256 kg.-cal. Solid CaF is formed by heating CaF_2 with Ca at 1230°. The heat of sublimation of CaF is probably approx. the same as that of Ca. H. J. E.

Mechanism of the primary photodissociation processes of organic molecules. E. BERGMANN and R. SAMUEL (Nature, 1938, **141**, 832—833).—A theory of photodecomp. of org. mols. is advanced. Two linkings are broken simultaneously, not by the splitting of two single linkings, but by a transition of the mol. from the ground state to a repulsive electronic state which is due to the repulsive character of the S^2 group of electrons of the central atom. Data are given and dissociation processes assumed for CI_4, CH_2O, Ac_2, EtOAc, and $MeCS_2H$. L. S. T.

Distribution of the rotation states in an elementary molecular formation process (not Boltzmann distribution) and alteration of the relative probability of transition. H. SCHÜLER and H. GOLLNOW (Z. Physik, 1938, **108**, 714—725).—The intensity curves of the P and R branches of the CuH band, λ 4280, have been determined for excitation (*a*) in the arc and (*b*) in a hollow cathode cooled by liquid air or H_2O. In (*a*) a Boltzmann distribution among the rotation states was found. In (*b*) a different but simple distribution was found. Results are discussed in relation to transition probabilities. H. C. G.

Near ultra-violet bands of acetylene. S. C. WOO, T. K. LIU, T. C. CHU, and W. CHIH (J. Chem. Physics, 1938, **6**, 240—246).—The near ultra-violet spectrum of C_2H_2 has been investigated at room temp. and at 300°; about 1000 lines and bands have been measured. Most bands show intensification at

the higher temp. Seven progressions with reasonable intensity distribution and all with a frequency of approx. 1050 cm.$^{-1}$ have been found; of these, three show no intensification at higher temp. indicating that they arise from transitions from a vibrationless level in the ground state to different vibrational levels in the excited state. All the bands are double-headed with degradation towards the red. Tentative assignments are given. W. R. A.

Absorption spectra of praseodymium and neodymium in heavy water. S. M. KATSCHENKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 557—558).—The absorption spectra of $Pr_2(SO_4)_3$ and $Nd_2(SO_4)_3$ in D_2O and in H_2O have been compared in the region of 5000 A. In D_2O the bands are wider and less intense and are shifted towards the violet by 30—35 cm.$^{-1}$ The dependence of the spectra on temp. is not the same in the two solutions, and the salts dissolve more slowly, and the solutions are more intensely coloured, in D_2O than in H_2O. F. J. G.

Spectroscopic study of the symmetries of the fields about ions in solution. S. FREED and S. I. WEISSMANN (J. Chem. Physics, 1938, **6**, 297).—The absorption spectra of $EuCl_3$ and $Eu(NO_3)_3$ indicate, on account of the no. of lines appearing in a particular group near 4650 A., that the field surrounding $Eu^{\cdots}$ in $EuCl_3$ is of lower symmetry than that in $Eu(NO_3)_3$. The symmetry of $Eu^{\cdots}$ is raised when anhyd. $Eu(NO_3)_3$ is dissolved in Et_2O and when it is combined with $Mg(NO_3)_2$. W. R. A.

Continuous absorption spectra of alkyl iodides and alkyl bromides and their quantal interpretation. D. PORRET and C. F. GOODEVE (Proc. Roy. Soc., 1938, **A**, **165**, 31—42).—The extinction coeff. curve for MeI has been analysed and the existence of two bands deduced. Extinction coeffs. of EtI, EtBr, and BuBr are measured. The influence of the C chain is small, and conditions under which the chromophoric groups retain their individuality are discussed. G. D. P.

Spectra of R_1–R_1 systems. IV. Spectra of *l*-ascorbic, hydroxytetronic, reductic, and α-crotonic acid. H. MOHLER and H. LOHR (Helv. Chim. Acta, 1938, **21**, 485—496; cf. A., 1937, I, 597).—Absorption spectra of the acids named and of CMe_2:CH·COMe, alone and in presence of $CuSO_4$ and/or KCN, are compared. The characteristic absorption is due to the ethylenic linking and is modified by substituents. Both $CuSO_4$ and KCN form compounds with ascorbic acid. Oxidation of this acid is due to ionisation to an unstable resonance system; KCN prevents oxidation by combining with this system. R. S. C.

Line breadths of the HCN bands. E. LINDHOLM (Z. Physik, 1938, **109**, 223—235).—Measurements of line breadths in the photographic infra-red rotation–vibration bands of HCN are given. The close relation between the line broadening and the quantum state is explained theoretically. L. G. G.

New band in the absorption spectrum of the earth's atmosphere. A. ADEL and C. O. LAMPLAND (Astrophys. J., 1938, **87**, 198—203).—A new band at 7·6 μ. is attributed to the presence of N_2O_5 in the ozonosphere. One mol. of N_2O_5 to 100 of O_3 is indicated. L. S. T.

Molecular association studied in the infra-red. J. ERRERA and H. SACK (Trans. Faraday Soc., 1938, **34**, 728—742).—An infra-red spectrometer is described and its precision discussed. Absorption measurements with 1% EtOH in $COMe_2$, dioxan, and in C_5H_5N reveal a characteristic band at 3500 cm.$^{-1}$ in the first two and at 3350 cm.$^{-1}$ in the last, which is attributed to the formation of O–H←O and O–H←N complexes respectively. These complexes are relatively stable, as is shown by their continued existence on dilution with CCl_4 and by their insensitiveness to temp. change. The influence of solvents on the chelation band in *o*-OH·C_6H_4·CHO has been studied. In CCl_4 the band is scarcely affected by changing the concn., whence it is inferred that the tendency to association is nearly eliminated by the chelation. The effect of dioxan, however, is to diminish the chelated character of the O–H and to allow association. F. L. U.

Temperature effect in the infra-red spectrum of phenol. R. R. BRATTAIN (J. Chem. Physics, 1938, **6**, 298—299).—The infra-red absorption spectrum of PhOH from I to 15 μ. has been determined at 25°, 42°, and 101°. The band at 3·1 μ. (25°) shifts to 2·96 μ. when PhOH melts (42°) and to 2·92 μ. at 101°, indicating that the degree of association has remained unaltered between 42° and 101°. The bands at 7·33 μ. and 8·16 μ. shift progressively to longer λλ on raising the temp. and the intensity and breadth of the 8·16 μ. band also increase. W. R. A.

Hydrogen bond and infra-red absorption. A. M. BUSWELL and W. H. RODEBUSH (J. Chem. Physics, 1938, **6**, 296—297).—Priority claim over Herman and Hofstadter (A., 1938, I, 174). W. R. A.

Infra-red and Raman spectra of polyatomic molecules. II. *cis*- and *trans*-Δ^β-butene. H. GERSHINOWITZ and E. B. WILSON, jun. (J. Chem. Physics, 1938, **6**, 247—251).—Using the automatic prism spectrometer (A., 1938, I, 328) the infra-red absorption spectra of gaseous *cis*- (I) and *trans*-Δ^β-butene (II) have been determined from 435 to 750 cm.$^{-1}$ with a KBr prism and from 750 to 4000 cm.$^{-1}$ with a NaCl prism. The Raman spectra of both compounds, as liquids, have also been determined and the polarisation of the lines of (II) has been investigated by the Polaroid method (*ibid.*, 230). (I) is usually attributed to the high-boiling and (II) to the low-boiling isomeride. (II), therefore, has a centre of symmetry and coincidence of Raman and infra-red frequencies is accordingly prohibited by selection rules. The spectroscopic evidence justifies the usual assignments of the isomerides. No conclusion regarding the free rotation of the Me groups is yet possible and doubt is cast on the validity of the assumption that both (I) and (II) have the same vibrational entropies. W. R. A.

Combination spectra of the solution of water in dioxan and pyridine. G. S. LANDSBERG and V. S. MALISCHEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 549—551).—The broad band 3460 cm.$^{-1}$ of

H_2O is split into two relatively narrow bands and shifted slightly towards the higher frequencies at high dilution in dioxan. In C_5H_5N the band is narrower but the position of the max. is unchanged. F. J. G.

Infra-red absorption spectra of gossypol derivatives. A. M. ZAMISCHLAEVA and S. S. KRIVITSCH (J. Gen. Chem. Russ., 1938, 8, 319—329).—The absorption spectra of certain gossypol derivatives (dioxime, Ac_6, dianiline and its Ac_6 compounds) are given for λλ 1·5—9 μ. R. T.

Infra-red absorption spectra of isomeric aliphatic hydrocarbons. P. LAMBERT and J. LECOMTE (Compt. rend., 1938, 206, 1174—1176; cf. A., 1934, 583).—νν of absorption maxima in the range 500—1450 cm.$^{-1}$ are recorded for *n*- and *iso*-C_5H_{12} and for 17 isomeric octanes. A band at 722 cm.$^{-1}$ in *n*-C_8H_{18} is displaced to higher νν, and decreases in intensity, with increasing complexity of the C chain. The intensity of a band at 1450 cm.$^{-1}$ also decreases in the more complex isomerides. The constituents of petroleum fraction are readily identified by their absorption spectra in the range considered. A. J. E. W.

Infra-red absorption spectrum of methylene chloride. C. CORIN and G. B. B. M. SUTHERLAND (Proc. Roy. Soc., 1938, **A**, 165, 43—53).—26 bands, of which 16 are new, are recorded in the region between 2 and 12 μ. for the liquid. As one of the intense bands has no counterpart in the Raman spectrum it has been necessary to introduce a new set of fundamental frequencies in terms of which the observed bands are interpreted. G. D. P.

Optical investigations on the adsorption of porphyrins. F. BANDOW (Z. physikal. Chem., 1938, **B**, 39, 155—193; cf. A., 1937, I, 61).—Data are recorded for the positions of the band max. in the fluorescence spectra of porphyrins in acid, alkaline, and neutral org. solvents, and when adsorbed from such solutions on Al_2O_3, $CaCO_3$, frankonite, floridin, and kaolin. There was in general a correspondence between the fluorescence spectra in solution and in the adsorbed state, with no systematic displacements to the red in the latter case. The quantum yield in the fluorescence of porphyrin solutions was <1; for adsorbed porphyrins, particularly on moist adsorbents, it was $>$ that in solution. The intensity of fluorescence in solution was used in measuring the adsorption from 5% HCl, 0·4% NaOH, EtOH, and dioxan on to C, Al_2O_3, $CaCO_3$, $Be(OH)_2$, BeO, kieselguhr, kaolin, talcum, floridin, and frankonite. The distribution coeffs. between solid and liquid varied widely. In many cases the porphyrin was readily washed out of the solid phase. H. J. E.

Fluorescence of methylacridone and the effect on it of atomic electric fields. A. SCHÖNTAG and H. FISCHER (Z. physikal. Chem., 1938, **B**, 39, 411—430).—Data are recorded for the displacement of the fluorescence band of methylacridone (I) in solutions of varying p_H. The displacement is attributed to distortion of the mol. by $H^·$ ions. The fluorescence spectrum of (I) in H_2O or CCl_4 solution at −195° shows a definite structure. The results are discussed in terms of the potential energy curve of the fluorescence electrons. H. J. E.

New example of chemiluminescence. J. H. HELBERGER (Naturwiss., 1938, 26, 316—317).—When the Mg salt of phthalocyanine was dissolved in boiling tetralin an intense red luminescence was observed. The effect is due to the presence of a small amount of a peroxide in commercial tetralin. Similar results were obtained with the Mg complexes of the porphyrin group, and the Zn complexes of phthalocyanine, tetrabenzoporphyrin, and mesoporphyrin. Cu and Fe complexes, and the free dyes, however, do not show the effect. The phenomenon may be of interest in connexion with assimilation. A. J. M.

Luminescence of solid substances. N. RIEHL (Angew. Chem., 1938, 51, 300—304).—A review.

Inorganic phosphors without metallic activator. W. H. BYLER (J. Amer. Chem. Soc., 1938, 60, 1247—1252).—Hydrated $ZnSO_4$, $MgSO_4$, or $SrCl_2$ develops fluorescence when heated at temp. which effect partial dehydration; at higher temp. the fluorescence is reduced. $BaCl_2$ becomes fluorescent when heated above its transition temp.; $Al(OH)_3$, $Ca(OH)_2$, and $Mg(OH)_2$ when partly decomposed by heating; $3Ca_3(PO_4)_2$,$Ca(OH)_2$, $Ca_3(PO_4)_2$, and $CaHPO_4$ when heated at 400°. A $Ca_3(PO_4)_2$-$CaHPO_4$ mixture gives greater intensity than either constituent alone. It is concluded that, in absence of a sp. metallic activator, the fluorescence is due to formation of complexes of crit. composition through partial decomp., or of crit. physical condition through modification of crystal structure. E. S. H.

Growth and decay of phosphorescence in calcium sulphide. P. J. MULDER (J. Franklin Inst., 1938, 225, 527—547).—The phosphorescence of CaS in different binding materials has been stimulated by light and the total intensity of all λλ emitted measured as a function of time. Similar results are obtained at various temp. if the excitation time is const. For CaS in a given binder a very good empirical relation has been deduced giving the phosphorescence intensity for any temp. within the specified range at any time after the beginning of excitation. T. H. G.

Ultra-violet phosphorescence of X-rayed rock-salt crystals. M. N. DIATSCHENKO (Physikal. Z. Sovietunion, 1938, 13, 55—64).—A sensitive photoelectron counter for radiation of $\lambda < 3300$ A. is described. The phosphorescence of a NaCl crystal, excited by *X*-rays, declines with time according to the law $N = N_0 e^{-t \times \text{const.}}$. The phosphorescence reaches saturation after 3 min. exposure. It begins with about 40-kv. *X*-rays, and attains saturation with 110-kv. rays. It comprises radiations of <1900 A. and of 1900—2500 A. J. W. S.

Raman effect in boric acid and in some boron compounds. S. M. MITRA (Indian J. Physics, 1938, 12, 9—14).—Boric acid solution gives Raman lines at 515, 872, and 986 cm.$^{-1}$, whilst the solid acid shows the frequency 882 cm.$^{-1}$ and two broad lines at 3195 and 3290 cm.$^{-1}$ due to the vibrations of O–H. It is concluded that $B(OH)_3$ has symmetry D_{3h}. Results are also included for Me, Et, and Bu borates. T. H. G.

Raman effect. LXXXIII. Nitrogen compounds. II. (Azomethane, *as*-dimethylhydrazine, methyl azide, hexamethylenetetramine.) L. KAHOVEC, K. W. F. KOHLRAUSCH, A. W. REITZ, and J. WAGNER (Z. physikal. Chem., 1938, **B**, **39**, 431—444).—Comprehensive data are recorded and discussed. H. J. E.

Raman spectrum of some crystalline powders. E. CANALS and P. PEYROT (Compt. rend., 1938, **206**, 1179—1181).—Raman νν have been determined for powdered $C_{10}H_8$, $H_2C_2O_4$, tartaric acid (I) and five tartrates, citric acid (II), $(CH_2)_6N_4$ (III), antipyrine (IV), and pyramidone (V), and for aq. (I) and (II). The C:O frequency found with OH-acids is strongly intensified in the cryst. state (cf. A., 1935, 146). Duplication of lines occurring with (I) and (II) is attributed to the existence of two forms in the cryst. state. A line at 1035 cm.$^{-1}$, attributed to CN, is found with (III) and (IV), but not with (V). A. J. E. W.

Raman effect in liquid ethane. G. GLOCKLER and M. M. RENFREW (J. Chem. Physics, 1938, **6**, 295).—The Raman spectrum of liquid C_2H_6 at −120° is recorded and compared with existing data for the liquid and gaseous states. W. R. A.

Quantitative investigation of the polarisation of Raman lines from crystals. H. MICHALKE (Z. Physik, 1938, **108**, 748—770).—An apparatus for measuring the intensity and depolarisation of Raman lines from crystals and optically active substances is described. Measurements are recorded for calcite, quartz, and beryl. For calcite results agree with theory, but difficulties arise with vibrations of the CO_3 group; these are discussed. Results for quartz and beryl agree with deductions from infra-red silicate spectra recorded by Schaefer, Matossi, and Wirtz. H. C. G.

Simultaneous Raman diffraction by multiple supersonic waves. L. BERGMANN and E. FUES (Z. Physik, 1938, **109**, 1—13).—The diffraction of light by two or more superimposed systems of supersonic waves in liquids and in glass has been examined. The complex diffraction patterns obtained are discussed with the aid of an extension of the Raman–Nath calculation. H. C. G.

Origin of the new Raman lines due to molecules in the solid state and of the "wing" due to liquids. S. C. SIRKAR and J. GUPTA (Indian J. Physics, 1938, **12**, 35—46).—The Raman spectra of polycryst. masses of PhMe, *cis*- and *trans*-CHCl:CHCl, $(CH_2Cl)_2$, and a mixture of *o*-, *m*-, and *p*-xylene have been measured in the low-frequency region. Intense new lines are observed with the centro-symmetrical mols. but not with others. The new lines are therefore not due to lattice oscillations, nor do they spread out to give the "wing" in the liquid state. The extinction directions of *p*-$C_6H_4Cl_2$ at room temp. and below 12° are the same; hence the orientation of the mols. does not change, as suggested by Vuks. T. H. G.

Anomalous depolarisation of the light scattered by binary mixtures. B. K. MOOKERJEE (Indian J. Physics, 1938, **12**, 15—24).—Investigations have been made of (*a*) the distribution of intensity in the "wing" of the Rayleigh line due to a mixture of CS_2 and MeOH at the crit. solution temp. and (*b*) the dependence of the depolarisation factor ρ_h for a similar mixture of PhOH and H_2O on the shape of the illuminated vol. Krishnan's theory of "cluster" formation is not supported. T. H. G.

Scattering of light in liquids. M. PEYROT (Ann. Physique, 1938, [xi], **9**, 335—407).—Measurements are described and results tabulated, with all comparative available data, for the depolarisation factors and the relative intensities of light scattered without change of λ in H_2O and in 40 org. liquids. From the depolarisation factors, qual. estimations of the optical anisotropy of the mols. are made and discussed. The abs. mol. scattering of C_6H_6 has been measured. Results are discussed in relation to those given by various formulæ. N. M. B.

Formation of mercury molecules. II. F. L. ARNOT and M. B. M'EWEN (Proc. Roy. Soc., 1938, **A**, **165**, 133—147; cf. A., 1936, 410).—The balanced space-charge method is used to study the formation of ionised Hg mols. It is concluded that three processes are operative: one involves a collision between two excited atoms, the others a collision between one excited and one normal atom. The appearance potentials for the processes are given. It is suggested that only atoms in *P* states form attachments with normal atoms leading to the formation of mol. ions. G. D. P.

Electronic affinity of gases. L. GOLDSTEIN (Ann. Physique, 1938, [xi], **9**, 723—803).—The electronic affinity of O_2, SF_6, and CF_4 in the pure state, and when mixed with A, Xe, and Kr, has been examined on the basis of the fact that attraction of electrons by mols. with formation of ions is a problem of electronic collision. The mols. O_2, SF_6, and CF_4 in the pure state behave towards slow electrons as inert gases, there being no tendency for the formation of ions by the capture of electrons. Electro-negative centres produced artificially, *e.g.*, by excitation, and dissociation, or in the case of mixtures with inert gases, by metastable atoms of the admixed gas, can cause capture of electrons. The range of speeds of electrons which can be captured to form ions extends from 0·12 e.v. to that corresponding with the first excitation levels of the mols. concerned. The ionisation potentials of O_2, SF_6, and CF_4 were determined. The vals. for O_2 are 12·6, 16·2, and 21·3 e.v., and for SF_6 and CF_4, 19·3 and 17·8 v., respectively. A. J. M.

Characteristics of the system copper–cuprous oxide–copper. E. WEHNER (Physikal. Z., 1938, **39**, 445—454).—Curves connecting current with voltage, pressure, and contact surface have been obtained for the Cu–Cu_2O–Cu system, using both d.c. and a.c. The effect of pressure on the current diminishes with increasing pressure, although the effect differs for d.c. and a.c. Two rectifications occur in opposite senses, and variation of voltage and pressure converts one steadily into the other. Rectifying action at the boundary between Cu_2O and applied electrode rises with increasing resistance, and hence with diminution

of pressure, surface, and potential, in agreement with Nordheim's theory of detector action. A. J. M.

Oscillographic examination of the unidirectional conductivity of carborundum. J. K. Bose and S. R. Khastgir (Z. Physik, 1938, **109**, 80—84).—50-cyclo a.c. at potentials up to about 15 v. was applied to carborundum and the rectification examined oscillographically against a suitable time-base. Multiple contacts at the crystal surface give much less rectification than single point contact, and the rectification diminishes with increase in applied voltage. L. G. G.

Dielectric after-effect phenomena in solid non-conductors. G. M. Voglis (Z. Physik, 1938, **109**, 52—79).—A comprehensive examination of the relationship between the charging or discharging current and time (10^{-2} to 10^3 sec.) for beeswax, mica, glass, and kerafar-U is described. L. G. G.

Measurements of dielectric loss and of high-frequency conductivity. III. Development and testing of the method of measurement and evaluation. H. Schwindt. **IV.** P. Wulff and H. Schwindt (Z. physikal. Chem., 1938, **B**, **39**, 275—289, 290—313).—III. The Rohde method (A., 1936, 1084) is applied to liquids. A condenser is described, suitable for hygroscopic or volatile liquids and also for use at low temp.

IV. A small dielectric loss (L) was observed in the pure non-polar liquids: C_6H_6, tetralin, paraffin, and C_7H_{16}. It was independent of frequency and temp. Presence of H_2O in C_6H_6 or Et_2O causes a measurable increase of L. With addition of an alcohol to a non-polar solvent, L at first remains almost const., and increases rapidly only beyond a certain concn., which depends on the alcohol used. The conductivity loss for solutions of an alcohol (*e.g.*, $Pr^{\alpha}OH$) in a non-polar solvent passes through a max. Data for the temp. and frequency dependence of L for alcohols are recorded. Solutions of fatty acids (*e.g.*, $Bu^{\beta}CO_2H$ in *iso*amyl acetate) show an increase of L on warming due to dissociation of the double mols. of acid. The effect is more marked in polar than in non-polar solvents. H. J. E.

Precision method for the determination of the molecular polarisation of non-dissociating liquids. G. Rösseler (Z. Physik, 1938, **109**, 150—152).—A reply to criticism (A., 1937, I, 347) and a correction of errors in the original (*ibid.*, 12). L. G. G.

Possibility of molecular rotation in the solid forms of cetyl alcohol and three long-chain ethyl esters. W. O. Baker and C. P. Smyth (J. Amer. Chem. Soc., 1938, **60**, 1229—1236).—Dielectric consts. of Et undecoate (I) palmitate (II), and stearate (III), and cetyl alcohol (IV) in the liquid and solid states have been determined over a wide range of temp. and ν. Solid (I) shows no general freedom of mol. rotation. (II) undergoes a solid α–β transition at the f.p., and during the process shows greater freedom of mol. rotation than in the liquid; it also shows a hitherto undetected slight transition in the β-form. (III) shows mol. rotation about the long axis in the α-form. (IV) shows mol. rotation in the α-form accompanied by strong anomalous dispersion of the dielectric const. Rotation about the long axes of mols. in the α-form appears to be possible, but in the β-forms, where the mols. are tilted with respect to the planes and more closely packed, no general freedom of rotation is found. E. S. H.

Dielectric constant of deuterium oxide. J. Wyman, jun., and E. N. Ingalls (J. Amer. Chem. Soc., 1938, **60**, 1182—1184).—Vals. of ϵ and its temp. coeff. for D_2O and H_2O at 0—100° are recorded. Throughout the range ϵ for D_2O is slightly < for H_2O; the temp. coeffs. are nearly equal. The results are discussed in relation to heats of solvation and heats of dilution of strong electrolytes. E. S. H.

Measurements of the dielectric constants of solids by means of ponderomotive forces. III. Rochelle salt. D. Dobrzyński (Bull. Acad. Polonaiso, 1938, **A**, 37—61; cf. A., 1938, I, 121, 160).—The dispersion of ϵ has been determined at 18·5° for a field of 58 v. per cm. ϵ_b and ϵ_c (~8) are normal; ϵ_a ~70 and 150 for $\nu\nu$ of 5×10^6 and 50 cycles, respectively. Anomalous dispersion (at 60—3000 m.) is due to resonance with piezoelectric $\nu\nu$. (Cf. A., 1934, 1291; 1935, 1452; *et al.*) I. McA.

Theory of the propagation of light in an atomically stratified medium. J. Weigle (Helv. Phys. Acta, 1938, **11**, 159—180).—A dynamic theory of the propagation of light in crystals is developed. O. D. S.

Absolute configuration of optically active substances. W. Kuhn (Naturwiss., 1938, **26**, 289—296, 305—310).—A review dealing with the determination of the abs. configurations of inorg. complex compounds {*e.g.*, $[Co(C_2O_4)_3]K_3$} and org. compounds (*e.g.*, CHMeEt·OH and related compounds), based on the study of the absorption bands of the mols. A. J. M.

General laws of dynamics and their application. G. A. Linhart (Riverside Jun. Coll., 1938, 8, 1—24).—Theoretical. By introducing the concept of energy of orientation, certain fundamental laws generally restricted to thermodynamics are shown to be applicable to all unidirectional dynamic processes. Applications discussed are: the penetration of cosmic rays into the earth's atm., magnetism and electromagnetic induction, and the formation of H_2O and D_2O. E. S. H.

Collective electron ferromagnetism. E. C. Stoner (Proc. Roy. Soc., 1938, **A**, **165**, 372—414).—A mathematical investigation of the problem of ferromagnetism. General equations are obtained, using Fermi–Dirac statistics, for the magnetic moment of a no. of electrons in an unfilled energy band of standard form, for which the interchange interaction effects give rise to a term in the energy expression $\propto$ the square of the magnetisation. Expressions are derived for the variation of magnetisation near the Curie point and at low temp. G. D. P.

Comparison of wave functions for HeH^{++} and HeH^{+}. C. A. Coulson and W. E. Duncanson (Proc. Roy. Soc., 1938, **A**, **165**, 90—115).—Various approximations are used in a comparative study of the wave functions. For the HeH^{+} ion the mol.-orbital approximation is better than the electron-pair.

Ionic and polar terms are included in the final wave function. G. D. P.

Structural formulæ of unsaturated hydrocarbons. M. BRUTZCUS (Compt. rend., 1938, **206**, 1177—1179).—Modified formulæ for a no. of unsaturated compounds, obviating multiple linkings by the introduction of bivalent C, are proposed and discussed. The modifications are based on thermochemical considerations (cf. A., 1938, I, 253). A. J. E. W.

Formation of mesomeric systems. J. KENNER (Nature, 1938, **141**, 786—787; cf. A., 1938, I, 178).—The generalisation that mesomeric systems may readily be formed from others closely related to them throws light on many org. and inorg. reactions, several of which are discussed. L. S. T.

Theory of the liquid state. H. G. TRIESCHMANN (Z. physikal. Chem., 1938, **B**, **39**, 209—217).—A discussion of the postulates of general theories of the liquid state. H. J. E.

Theory of liquids. A. GANGULI (Indian J. Physics, 1938, **12**, 25—33).—A general distribution function of mols. is given and special cases for gases, liquids, and solids are considered. The various terms of London's expression for the potential energy are discussed with reference to rotation in liquids and solids, viscosity (η), polymerisation, formation of glasses, etc. Certain simplified expressions for the distribution function, cohesion, internal forces, η, etc. are reviewed and van der Waals' equation is considered; cohesive forces and η are calc. from it. Some formulæ for η and time of relaxation are obtained in a simplified manner. T. H. G.

Perturbations of crystal lattices. (A) Calculation of the heat of autodiffusion of metals and the heat of diffusion of solid solutions. (B) Calculation of the work of penetration of slow electrons into the crystal lattice of a salt. J. CICHOCKI (J. Phys. Radium, 1938, [vii], **9**, 129—132; cf. A., 1937, I, 296). O. D. S.

Modified method for measuring the temperature-dependence of the number of crystallisation nuclei in a supercooled organic liquid. G. L. MICHNEVITSCH, I. F. BROVKO, and A. V. BABADSCHAN (Physikal. Z. Sovietunion, 1938, **13**, 103—112).—A modification of Tammann's method is described which is suitable for substances with a large no. of crystallisation centres and high linear rates of crystallisation. A thin flat glass container is used and the temp. during exposure is kept const. to $\pm 0{\cdot}5°$. The curve relating temp. of nucleus formation to no. of centres formed in betol, for const. temp. of development, shows two max., at $-2{\cdot}9°$ and $1{\cdot}5°$, respectively. The former is ascribed to anomalous cooling adjacent to the walls of the container. J. W. S.

Stability of the crystallisation centres of an organic liquid at various temperatures and conclusions therefrom concerning Tammann's method. G. L. MICHNEVITSCH and I. F. BROVKO (Physikal. Z. Sovietunion, 1938, **13**, 113—122; cf. preceding abstract).—The process of "development" of submicroscopic nuclei by heating the supercooled melt causes instability and only some nuclei can grow to give spherolites and thereby become observable. The no. of these (z) varies with the temp. of nucleus formation (T_c) and of development (T_p) according to $z = z_0 e^{-\alpha(T_p - T_c)}$. α increases rapidly, *i.e.*, stability of centres decreases with diminishing T_c, so the curve connecting z with T_c for const. T_p is distorted and displaced towards higher temp. The question whether true max. exist in this curve is discussed. J. W. S.

Example of Brownian molecular motion. M. VON LAUE (Naturwiss., 1938, **26**, 317—318).—Calculation shows that in empty space a conducting sphere possesses thermal rotational motion when it is acted on by a magnetic field. The implications of this result are discussed. A. J. M.

Eigenvalue problem of a diatomic molecule and calculation of the energy of dissociation. S. K. CHAKRAVORTI (Z. Physik, 1938, **109**, 25—38).—Energies of vibration and dissociation of diat. mols. are calc. wave-mechanically and data given for BeH, CdH, C_2, and N_2. The method is superior to those of other authors in that higher order terms are included. Calc. vals. of the energy of dissociation of the above mols. agree more closely with experimental vals. than do those of Morse. L. G. G.

Quadrupole–quadrupole interatomic forces. J. K. KNIPP (Physical Rev., 1938, [ii], **53**, 734—745).—Mathematical. N. M. B.

Elimination of the mosaic crystal imperfection effect on width of *X*-[ray] lines. J. M. BAČKOVSKÝ (Nature, 1938, **141**, 872).—The two kinds of imperfection causing loss of resolving power in the *X*-ray spectra of crystals are due (i) to mosaic structure and (ii) to an irregular arrangement of the at. planes. The effect of (ii) is inappreciable, and that due (i) to can be made negligible by means of a symmetrical arrangement in which the distances, slit to crystal and crystal to photographic plate, are made equal. L. S. T.

Influence of chemical binding on *X*-ray absorption spectra. R. LANDSHOFF (Rev. Sci. Instr., 1938, **9**, 143—147).—A general survey. N. M. B.

Nature of ionic sign preference in C. T. R. Wilson cloud chamber condensation experiments. L. B. LOEB, A. F. KIP, and A. W. EINARSSON (J. Chem. Physics, 1938, **6**, 264—273).—The charge preference in Wilson cloud chamber condensations cannot be accounted for either by introduction of hygroscopic impurities into the embryonic droplet on capturing ions of different sign or by consideration of the electrical double layer at liquid–gas surfaces. Results for C_6H_6, $PhNO_2$, $CHCl_3$, $COMe_2$, AcOH (no $\pm$ effect), H_2O, EtI, NH_2Ph PhCl, PhMe, $HCl + H_2O$ (negative ion first) and EtOH, MeOH, AcOH, BuBr (positive ion first) are discussed. The saturated vapour is assumed to contain embryonic droplets of radius too small for surface forces to come into play and the mols. in these droplets are in a definite but pseudo-cryst. arrangement determined by van der Waals forces. The existence of such pseudo-cryst. droplets or groups in liquids

may account for the cybotactic state ascribed to them from *X*-ray diffraction studies. W. R. A.

Structure of metals. R. A. STEPHEN (Nature, 1938, **141**, 748; cf. A., 1938, I, 236).—Scatter of spots in high-dispersion *X*-ray photographs can also be due to (i) a purely geometrical effect due to the finite convergency of the *X*-ray beam and (ii) the finite width of the $K\alpha$ lines. (i) is too small to account for the scattering observed by Müller (A., 1938, I, 67), but (ii) gives results of the correct order. Serious errors in determining lattice consts. and deduced internal stresses will result unless this effect is taken into account. L. S. T.

Application of *X*-ray methods to problems of chemical binding. R. BRILL (Angew. Chem., 1938, **51**, 277—282).—A review, with detailed reference to the direct detection of ionic, homopolar, and H bonds and van der Waals forces, from 2-dimensional electron density projections obtained by Fourier synthesis of precision *X*-ray crystal data for NaCl, diamond, and $(CH_2)_6N_4$ (A., 1938, I, 124). I. McA.

Crystal structure of montmorillonite. E. MAEGDEFRAU and U. HOFMANN (Z. Krist., 1938, **98**, 299—323; cf. A., 1935, 1345; 1936, 1450; 1937, I, 17).—In powder *X*-radiograms made for several montmorillonites of varying composition and humidity, only (00*l*) and (*hk*0) reflexions of a rhombic cell with *a* 5·18, *b* 8·97 A., *c* variable, occur. A cross-lattice structure of parallel equidistant pyrophyllitic (A., 1934, 1162) layers (I), separated by layers of H_2O mols., and with 4 Al statistically distributed over the 6 octahedral centres, accords best with measured intensities. It differs from that of Clark *et al.* (A., 1938, I, 52) in assuming (i) continuous hydration, without discrete H_2O positions, (ii) absence of mutual orientation of (I) along *a* or *b*. The small effect, on intensities, of cationic substitution (6 Mg or 3 Fe + 1 Al for 4 Al) is ascribed to mean at. vibrations > calc. vals. (A., 1936, 15, 412, 538). I. McA.

Anomalous mixed crystals. II. Subsidiary components in mixed crystals of the iron ammonium chloride type. A. NEUHAUS (Z. Krist., 1937, **98**, 112—142; cf. A., 1936, 1477; 1938, I, 68).—The hygroscopic isomorphous monoclinic salt hydrates $MCl_2,2H_2O$ (I) (M = Mn, Co, Fe, and Ni) together with $FeCl_3,H_2O$ (II), $NiCl_2,2H_2O$ (stable rhombic form) (III), $MnCl_2,2NH_4Cl,2H_2O$ (IV), and $FeCl_3,2NH_4Cl,H_2O$ (V), have been prepared, and crystal properties (goniometric, mechanical, optical, and *X*-ray) measured and summarised. In combination with NH_4Cl, (II) and (III) deviate from the uniform behaviour of (I). Like their Cu analogue (IV) and (V) show a pseudo-cubic symmetry and intergrowth; the spatial equality of their components favours anomalous miscibility. The extent, mechanisms, and relations of anomalous mixed systems are discussed. I. McA.

Structure of trisodium tricyanomelamine trihydrate. J. L. HOARD (J. Amer. Chem. Soc., 1938, **60**, 1194—1198).—*X*-Ray data indicate a hexagonal unit with a_0 10·23 and c_0 5·56 A., containing $2Na_3C_6N_9,3H_2O$; space-group D_{3h}^4—$C\bar{6}2c$. E. S. H.

α–β Transformation of manganese. G. JOHANNSEN and H. NITKA (Physikal. Z., 1938, **39**, 440—445).—The thermal expansion, electrical conductivity, and *X*-ray crystal structure of Mn have been determined at high temp. The arrest at 682° previously obtained by thermal methods is due to supercooling of the β-phase. The α–β transition point for 95% Mn is 640—650°, and for 99·95% Mn, 640—710°, both determined by cooling. The val. for 95% Mn determined by heating is 750—800°. A. J. M.

Nature of chemical linkings. I. Chiolite and similar compounds. V. CAGLIOTI and G. GIACOMELLO (Naturwiss., 1938, **26**, 317).—The space-group of chiolite has been obtained by the Patterson method of analysis; $a = 4·96 \times 2$, $c = 5·16$ A. The formula is $6NaAlF_4,4NaF$. A. J. M.

Crystal structure of ammonium chlorobromoiodide and configuration of the chlorobromoiodide group. R. C. L. MOONEY (Z. Krist., 1938, **98**, 324—333; cf. A., 1935, 812).—By *X*-ray analysis, NH_4ClIBr (prep. described) has 4 mols. in the rhombic unit cell with *a* 6·13, *b* 8·50, *c* 9·94 A.; $\rho_{calc.}$ 3·32; space-group V_h^{16} (*Pmcn*). The complete 8-parameter structure is determined (by Fourier synthesis and otherwise) from visual intensities. ClIBr′ is rectilinear with I central; Cl—I is 2·38, and I—Br 2·50 A. NH_4^+ is surrounded by 4 Cl and 4 Br in pseudo-cubic alternation at average distances of 3·35, 3·56 A., respectively. NH_4—I is $\lessapprox$3·94 A. I. McA.

***X*-Ray studies of the structure of hair, wool, and related fibres. IV. Molecular structure and elastic properties of the biological cells.** H. J. WOODS (Proc. Roy. Soc., 1938, **A, 166**, 76—96).—Cells isolated from different types of hair are found to contain cryst. keratin, and they can be built up into tissues giving *X*-ray photographs comparable with those obtained from the fibres. Cells from retted fibres previously set in steam are found to be stretched but their measured lengths are < would be expected, indicating that the elastic phase extends inside the cells as well as between them. By the combined action of pressure and steam the cells can be formed into coherent transparent sheets, elastic in H_2O up to 50% extension and extensible in steam or aq. NaOH to 100%. These sheets can be relaxed, set, and supercontracted in the same way as fibres. It is concluded that the behaviour of the fibres is for the most part determined by the properties of the cells. G. D. P.

Structure of plastically deformed crystals and mechanism of deformation. A. P. KOMAR (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 789—795; cf. A., 1936, 552, 1449; 1937, I, 117).—The deformation in bent or strained crystals of NaCl, Al, and Mg is interpretable from Laue *X*-radiograms, using previous methods (*loc. cit.*) and Taylor's slip theory (A., 1934, 950). I. McA.

Arrangement of molecules in a single layer and in multiple layers. L. H. GERMER and K. H. STORKS (J. Chem. Physics, 1938, **6**, 280—293).—When a highly polished Cr-plated block is dipped through a unimol. film of stearic acid (I) or Ba stearate (II) a single layer of mols. is deposited. Each subsequent

dipping leads to the deposition of two layers. The reflexion of fast electrons from such odd-numbered layers has been investigated. Even-numbered layers are deposited when thin foils of Resoglaz are dipped under similar conditions; two layers are deposited at each dipping, including the first. These layers have been studied by transmission methods. For a single layer of (II) and of (I) on a Cr surface the hydrocarbon chains are closely packed but arranged irregularly and the axes of the chains lie approx. normal to the surface. With odd-numbered layers of mols. it appears that the layer nearest the Cr surface is, like a single layer, close packed but arranged irregularly whilst in the subsequent layers the mols. are arranged regularly in the same manner as on Resoglaz. Even-numbered layers of (II) on Resoglaz give a diffraction pattern which indicates that the mols. are arranged as simple crystals having hexagonal symmetry, that all layers are regularly arranged, and that the chain axes are normal to the surface. In all except the first layer on a Cr-plated surface and in all layers on Resoglaz, (I) mols. are arranged regularly and are built into monoclinic crystals with *a* 8·27, *b* 4·96 A., β 70°; the *a* and *b* axes are parallel to the supporting surface, the *b* axis showing strong preference for the direction normal to the dipping plane. The unique irregular arrangement of the first layer on a Cr surface has been found also for a polished steel surface. On Resoglaz the paraffin end of the mol. is in contact with the foil whereas on the metal support the Ba or CO_2H groups make contact. It is suggested that the first layer of (I) may react with the metal to form a stearate whilst subsequent layers remain uncombined. The significance of the formation of a metallic stearate (or similar compound) on boundary lubrication may possibly be capable of investigation by electron diffraction methods. Polymorphic forms of (I) crystals are discussed. A single layer of Ba myristate has also been examined and gives results very similar to a single layer of (II). With improved vac. technique it is predicted that layers of adsorbed gases could be investigated by electron diffraction methods.

W. R. A.

Crystal and molecular structure of CBr_4 and CI_4. H. MARK (Z. physikal. Chem., 1938, **B**, **39**, 314).—The correctness of Finbak and Hassel's data is affirmed (cf. A., 1937, I, 502). H. J. E.

Isomorphism of $BaCdCl_4,4H_2O$ and $BaPt(CN)_4,4H_2O$. H. BRASSEUR and A. DE RASSENFOSSE (Z. Krist., 1938, **98**, 353—355).—In reply to Quodling and Mellor (A., 1938, I, 180) the evidence for and against isomorphism is reviewed. I. McA.

Crystal growth on calcite surfaces. G. I. FINCH and E. J. WHITMORE (Trans. Faraday Soc., 1938, **34**, 640—645; cf. A., 1937, I, 226).—The orientation of $NaNO_3$ crystals grown on surfaces of calcite is wholly determined by the substrate crystal surface. Where the latter is of single crystal structure continuous with that of the main crystal, the $NaNO_3$ crystals are oriented and continue as far as possible the at. arrangement of the underlying calcite, but where the polish layer is shown by electron diffraction to be amorphous, the overgrowths of $NaNO_3$ are unoriented. Hence the overgrowth experiments provide independent confirmation of the conclusions based on electron diffraction examination.

F. L. U.

Measurement of the periodic internal potential of crystals. A. HAUTOT and J. J. TRILLAT (J. Phys. Radium, 1938, [vii], **9**, 133—139; cf. A., 1938, I, 63).—A theory of electron diffraction in metallic crystals, based on the classical theory of metals, is developed. Vals. for the coeffs. of the periodic internal potential of Ni, Au, Cu_2O, and graphite crystals calc. by this theory from the breadth of electron-diffraction rings produced by the crystals are of the order of magnitude of those derived from a consideration of the electrical properties of the atoms of the crystal. O. D. S.

Structure of sulphur by means of cathode rays. J. J. TRILLAT and S. OKETANI (Z. Krist., 1938, **98**, 334—343; cf. A., 1934, 1296; 1938, I, 67).—S films prepared by evaporation of CS_2 solutions on H_2O or Au leaf gradually sublime in vac. By electron diffraction, they are shown to consist of flat rhombic single crystals of variable orientation. Powder diagrams are rarely obtained. Diffraction patterns corresponding with the (111), (011), (010), and (100) planes confirm Warren's *X*-ray structure (A., 1935, 285). Pattern changes during exposure are due to local reorientation, not to a thermal rhombic → monoclinic transition. I. McA.

Polymorphous forms of crystalline carbon compounds with long stretched chains, as determined by electron diffraction. T. SCHOON (Z. physikal. Chem., 1938, **B**, **39**, 385—410).—Stearic acid exists in two forms with *a* 5·62, *b* 7·54, *c* ≈ 50·0 A., β 61·2° and *a* 9·46, *b* 4·96, *c* ≈ 49·15 A., β 54·2°, respectively. Margaric acid has *a* 10·45, *b* 4·63, *c* ≈ 48·9 A., β 55°; cetyl alcohol, *a* 9·15, *b* 5·01, *c* ≈ 44·8 A., β 55·5°; palmitic acid, *a* 9·54, *b* 4·99, *c* ≈ 44·3 A., β 53·4°; dicetyl ether, *a* 5·64, *b* 7·43, *c* ≈ 43·4 A., β 62·9; cetyl palmitate, *a* 5·60, *b* 7·49, *c* ≈ 93 A., β 60·8°; $C_{30}H_{62}$ (first form), *a* 5·577, *b* 7·482, *c* ≈ 39·8 A., β 61·9°; (second form) *a* 4·955, *b* 7·51, *c* 39·94, β 90°; $C_{31}H_{64}$, *a* 4·97, *b* 7·49, *c* 82·22 A., β 90°; $CO_2H{\cdot}[CH_2]_8{\cdot}CO_2H$, *a* 9·6, *b* 5·0, *c* 13·8 A., β 55°; $CO_2H{\cdot}[CH_2]_{14}{\cdot}CO_2H$, *a* 9·5, *b* 5·0, *c* 21·3 A., β 54°. In these substances a small no. of elementary cells are characterised by the vals. of *a* and *b* and of the monoclinic angle β. The structure of long-chain paraffins and their derivatives, and the transition phenomena of certain paraffins, are accounted for in terms of these simple structural types. H. J. E.

Molecular structures of the methyl derivatives of phosphorus and arsenic. H. D. SPRINGALL and L. O. BROCKWAY (J. Amer. Chem. Soc., 1938, **60**, 996—1000).—Electron-diffraction investigations show that PMe_3 and $AsMe_3$ are pyramidal with P and As at the respective apices. PMe_3 has a bond angle 100±4° with P—C 1·87±0·02 A.; $AsMe_3$ has a bond angle 96±5° with As—C 1·98±0·02 A. These distances agree with published vals. for the sums of covalent radii. E. S. H.

Dynamic theory of space lattice diffraction. I, II. E. FUES (Z. Physik, 1938, **109**, 14—24, 236—259).—I. The theory of space lattice scattering is

derived as a "zero approximation" solution of a three-dimensional Hill differential equation.

II. The calculation of diffraction coupling of n intense waves in the lattice is dealt with. L. G. G.

Theory of electron diffraction considering more than two rays, and an explanation of the Kikuchi envelope. II. E. LAMLA (Ann. Physik, 1938, [v], **32**, 225—241; cf. A., 1938, I, 288).—Diffraction of electron beams at crystal lattice surfaces and the interaction between periodic surface disturbances and the incident electron beam are discussed mathematically. Conclusions are illustrated by reference to the diffraction at the surfaces of spinel and fluorspar. H. C. G.

Theories of electron diffraction. J. FARINEAU (J. Phys. Radium, 1938, [vii], **9**, 157—161).—The theories of Kikuchi (A., 1935, 570) and Harding (A., 1937, I, 172) are criticised. A theory is developed in which the crystal is treated as a three-dimensional diffraction grating. Derived vals. for the breadth of electron-diffraction rings are of the order of magnitude of experimental vals. O. D. S.

Influence of general blackening on atomic distances determined by means of electron diffraction. C. FINBAK and O. HASSEL (Z. physikal. Chem., 1938, **B**, **39**, 471—475).—It is shown that the general blackening causes errors in evaluating interat. distances. It is necessary to measure max. in the original negative and min. in the positive, and to use both sets of vals. in evaluating the results. H. J. E.

Electron-optical observations of ion and electron emission from cylindrical emission sources. H. MAHL (Z. Physik, 1938, **108**, 771—776).—A method for the simultaneous production of images by ion and electron emission from an internally heated steatite tube is described. Destruction of the screen through ionic irradiation is prevented by electronic focussing of the secondary electrons derived from the ionic emission by bombardment of an auxiliary electrode. L. G. G.

Drift of adsorbed thorium on tungsten filaments heated with direct current. R. P. JOHNSON (Physical Rev., 1938, [ii], **53**, 766).—The migration towards the negative terminal of Th adsorbed on W is demonstrated directly in a simple electron-optical tube. N. M. B.

Lattice perturbations, particle size, and heat content of pyrophoric iron. R. FRICKE, O. LOHRMANN and W. WOLF (Z. physikal. Chem., 1938, **B**, **39**, 476; cf. A., 1937, I, 603).—A correction. H. J. E.

Surface phenomena in the cold-working and recrystallisation of metals. G. A. HOMES (Bull. Acad. roy. Belg., 1938, [v], **24**, 147—158).—Lattice breakdown by drawing is propagated from the surface towards the interior of the metal under tension. Polishing can produce superficial breakdown, a limiting case being obtained in the amorphous layer detectable by electron diffraction. The growth of new crystals may occur across certain discontinuities, beginning at points where lattice deformation is locally very strong, but such recrystallisation may be masked by the persistence of the contour of the original crystals. J. W. S.

Distinction between the mechanism of static rupture and that of dynamic rupture in crystals. G. A. HOMES and P. DUWEZ (Bull. Acad. roy. Belg., 1938, [v], **24**, 159—162).—Whilst static rupture occurs through progressive deformation of all the crystals, fatigue rupture is produced by the progressive deformation of certain parts of the specimen only. The no. of crystals of which the lattices are distorted increases with increased no. of intermittent strains, but generally, at the moment when fracture occurs, there are a large no. of crystals which still remain intact. The repeated stress probably accentuates the unequal initial resistance of the individual crystals. J. W. S.

[Note on] recrystallisation. M. O. KORNFELD (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 845; cf. A., 1938, I, 179). I. McA.

Magnetic structure of cobalt. W. C. ELMORE (Physical Rev., 1938, [ii], **53**, 757—764).—The magnetic powder method was used to investigate Co crystals at room temp. A stable colloid of γ-Fe_2O_3 was deposited on suitable sections of Co crystals by a magnetic field normal to the surface. Patterns are photographed and discussed in relation to the various energies involved in the demagnetisation of an ideal crystal. Results indicate that the Co patterns do not accord with the structure demanded by simple theory which neglects irreversible energy changes accompanying demagnetisation. A structure explaining the observed patterns is proposed and discussed. N. M. B.

Rotational moment of single cubic crystals in a magnetic field. H. MUSSMANN and H. SCHLECHTWEG (Ann. Physik, 1938, [v], **32**, 290—300).—The relation between the rotational moment of single crystals and the direction of the magnetic field is derived theoretically and compared with experiments on a single crystal disc. H. C. G.

Relation between the resistance of nickel crystals and the direction of spontaneous magnetisation. W. DÖRING (Ann. Physik, 1938, [v], **32**, 259—276).—The general relationship between the electrical resistance and the direction of magnetisation in cubic ferromagnetic crystals is derived from considerations of symmetry. Results are confirmed by experiments with Ni crystals. H. C. G.

Change of resistance of single crystals of zinc in a magnetic field. B. G. LASAREV and M. M. NOSKOV (Physikal. Z. Sovietunion, 1938, **13**, 130—132).—The electrical resistance of single-crystal Zn wires of various orientations has been measured in fields of 0 to 14,100 gauss at temp. of room and of liquid N_2. J. W. S.

Thermal and electrical resistance of a tungsten single crystal at low temperatures and in magnetic fields. W. J. DE HAAS and J. DE NOBEL (Physica, 1938, **5**, 449—463).—Thermal and electrical conductivities have been determined in high magnetic fields at low temp. The Wiedemann–Franz law holds in magnetic fields for the contribution made by electrons to these properties. By using still higher

fields it will probably be possible to separate the heat-conductivity into parts due to the lattice and the electrons. T. H. G.

Hall effect on single crystals of zinc. M. M. Noskov (Physikal. Z. Sovietunion, 1938, **13**, 127—129).—A formula is derived relating the Hall e.m.f. in single crystals to the orientation of the crystal and of the magnetic field; it is shown to be in accord with experiment for single crystals of Zn. J. W. S.

Resonance in crystal beams of sodium-ammonium tartrate. W. Mandell (Proc. Roy. Soc., 1938, **A**, **165**, 414—432).—The interaction of two longitudinal oscillations at right angles in a square beam is considered theoretically. If the natural frequencies in the two directions are sufficiently near equality resonance should occur with the production of two new fundamental frequencies. The result is found to agree with experiment. Experiments are also made to determine the change of λ with change of breadth and thickness of the beam. The effect of thickness is small, but change of breadth may alter λ by 20%. G. D. P.

Reflecting power of ultra-pure aluminium. P. Jacquet and L. Capdecomme (Nature, 1938, **141**, 752).—Electrolytically-polished surfaces of pure Al (99·998%) have the same reflecting power, which is uniformly const. over different points of the surface. When exposed to the atm., but protected from dust, no alteration in reflecting power occurs. With mechanically-polished surfaces, reflecting power is less and varies markedly from one surface to another, and from point to point in a given surface. L. S. T.

Value of Young's modulus for nickel wire as influenced by the diameter. T. F. Wall (Nature, 1938, **141**, 751—752).—Pure annealed wires of diameter $< \frac{3}{32}$ in. approx. show a rapid fall of the val. of Young's modulus with a decrease in diameter. A similar curve is obtained with Cu-plated Ni wires heated in H_2 to a condition of max. magnetic permeability. L. S. T.

Cause of premature rupture of crystals. A. V. Stepanov (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 797—813; cf. A., 1937, I, 504; 1938, I, 182, 183).—Further experiments on rock-salt, including the effect of grooves, and examination with polarised light of crystals stretched along [110] and [111] directions, confirm the primary cause as plastic deformation. The interaction of slip and local distortion is discussed. A range of tensile strengths 80—2000 g. per sq. mm. (normal val. ~500) is attainable under varied conditions. I. McA.

Alteration of the atomic lattice by plastic deformation in crystals. S. T. Konobeevski (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 845).—A summary. I. McA.

Mechanics of plastic deformation of crystals. M. V. Jakutovitsch (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 843—844). I. McA.

Theory of plastic deformation and twinning. J. Frenkel and T. Kontorova (Physikal. Z. Sovietunion, 1938, **13**, 1—10).—Theoretical. The process suggested comprises a caterpillar-like motion of one at. chain over another. J. W. S.

Twin formation [in crystals] as a lattice-geometry theory of numbers problem, with application to some real cases. III. I. Schaacke (Z. Krist., 1938, **98**, 281—298; cf. A., 1938, I, 234).—The principles developed previously are applied to the penetration twinning of fluorspar and pyrite. I. McA.

Electrical properties of vanadium pentoxide. I. K. Krch (Abh. Staatsuniv. Saratov, 1938, **14**, 54—71).—The prep. of single crystals of pure V_2O_5 is described. Vals. for the conductivity σ along the c axis between −125° and 175·5° are recorded. The expression $\sigma = \sigma_0 e^{-E/2RT}$ is confirmed, but E is 0·408 e.v. below 25° and 0·268 above 40°. Impurities lower σ and increase E. The Hall effect is positive between −32° and 31° and negative (*i.e.*, normal) between 31° and 101°. The e.m.f. of the thermocouple $Ag|V_2O_5$ has a max. at 25—35° (approx. 8×10^{-4} v. per degree). On cooling from 25° it decreases rapidly, and on warming above 35°, slowly; the cold joint is negative. An explanation of the results is based on the assumption that at low temp. the "holes" are more, and at higher temp. less, mobile than electrons. J. J. B.

Resistance of superconducting cylinders in a transverse magnetic field. A. D. Misener (Proc. Roy. Soc., 1938, **A**, **166**, 43—55).—Measurements of the field strength required to restore the first traces of electrical resistance at temp. below the normal transition point were made on specimens of Sn, In, and Pb. The ratio to the crit. field is a linear function of the temp. The results are consistent with the view that after penetration of the external field the cylinder breaks up into regions of normal and superconducting material. The existence of these regions is demonstrated experimentally. G. D. P.

Thermo-electromotive forces of a superconductor against the same metal in the non-superconductive state. W. H. Keesom and C. J. Matthijs (Physica, 1938, **5**, 437—448).—An e.m.f. should exist in a circuit consisting of a wire two parts of which are in different magnetic fields, if the places where there are field gradients are also at different temp. Such e.m.f. have been detected for Sn and In, the results in the latter case agreeing with those found previously. For Sn no comparison could be made. The observations agree broadly with the formula of Kok (cf. A., 1937, 1, 292). T. H. G.

Magnetic threshold values for superconductivity. M. von Laue (Ann. Physik, 1938, [v], **32**, 253—258).—Magnetic threshold vals. are calc. for a cylindrical conductor in a transverse field and for a conical conductor in a homogeneous field. H. C. G.

Paramagnetism of tritolylammonium perchlorate and Wurster-red. P. Rumpf and F. Trombe (J. Chim. phys., 1938, **35**, 110—113; cf. A., 1938, I, 238).—Wurster-red in MeOH is paramagnetic, supporting the structure proposed by Weitz (A., 1929, 190). The analogy with $[(C_6H_4Me)_3N]^+ClO_4^-$ is discussed. E. S. H.

Theory of susceptibility of paramagnetic alums in alternating fields. M. FIERZ (Physica, 1938, 5, 433—436).—The partial suppression of the paramagnetism of alums of the Fe group by high-frequency alternating fields is discussed. A formula is deduced which, although it gives results which are too low, correctly shows that the residual magnetisation is independent of the field but varies with temp. T. H. G.

Purification and magnetic properties of mercury. L. F. BATES and C. J. W. BAKER (Proc. Physical Soc., 1938, 50, 409—412).—Differences in the magnetic properties of several specimens of Hg purified by Hulett's method were removed by subsequent heating in vac. at 260° for some time. The temp. variation of the mass susceptibility of Hg so treated was measured and results are discussed with reference to Stoner's theory (cf. A., 1936, 266). N. M. B.

Magnetic susceptibility of the iron in ferro-hæmoglobin. D. S. TAYLOR and C. D. CORYELL (J. Amer. Chem. Soc., 1938, 60, 1177—1181).—The paramagnetic susceptibilities per formula-wt. of Fe in hæmoglobins of the cow, horse, sheep, and man are 12,290, 12,260, 12,390, and 11,910 $\times 10^{-6}$ c.g.s.u., respectively, at 25°. For cow hæmoglobin this quantity is const. for different individuals and unaffected by hæmolysis. The calc. magnetic moment for cow hæmoglobin is $5{\cdot}435 \pm 0{\cdot}015$ Bohr magnetons; for horse, sheep, and human hæmoglobin the moments are 5·43, 5·46, and 5·35, respectively. The presence in normal blood and in oxyhæmoglobin solutions of hæmoglobin-like compounds which do not combine with O_2 is noted. Fe is present as Fe^{III} in these compounds; its at. paramagnetic susceptibility has been approx. determined. The hæmoglobin concn. determined from the CO capacity after reduction agrees with that determined from the Fe content. Hæmoglobin concns. can be determined magnetometrically with high precision. E. S. H.

Diamagnetic susceptibility of bismuth. M. BLACKMAN (Proc. Roy. Soc., 1938, **A**, 166, 1—15).—An extension of the theoretical treatment, consisting of a more general assumption as to the form of the surface of const. energy of the electrons, leads to a satisfactory account of the observed variations of susceptibility of Bi with field strength at low temp. G. D. P.

Determination of elastic constants by means of ultrasonic waves. A. WALTI (Helv. Phys. Acta, 1938, 11, 113—139).—Positions of max. and min. transparence of thin glass wedges to ultrasonic waves from 1×10^6 to $12{\cdot}48 \times 10^6$ Hz. have been determined. Derived vals. for the elastic consts. of glass agree with static vals. The conclusions of Bez-Bardilli (cf. A., 1935, 289) are criticised. O. D. S.

Precision method for the determination of supersonic wave velocity in liquids. N. SEIFEN (Z. Physik, 1938, 108, 681—697).—The accuracy of the visual method, developed by Hiedemann and his co-workers for measuring the velocity of sound in liquids, has been improved by referring all frequency measurements to the natural frequencies of an accurately calibrated quartz rod. Measurements are recorded for H_2O, PhMe, NH_2Ph, xylene, $PhNO_2$, and CCl_4, and the temp. coeffs. calc. over the range 23—27°. H. C. G.

Absorption of ultrasonic waves by organic liquids. S. PARTHASARATHY (Current Sci., 1938, 6, 501—502).—Data for 21 org. liquids, including hydrocarbons, aliphatic alcohols and acetates, PhCl, $CHCl_3$, CCl_4, $COMe_2$, and CS_2, are recorded for the frequency range 3 to 16 M-cycles. The coeffs. for C_6H_6, $CHCl_3$, CCl_4, and CS_2 are markedly high, and the vals. of γ obtained from the data for these liquids are also high. L. S. T.

Sound absorption and dispersion in liquids. H. O. KNESER (Ann. Physik, 1938, [v], 32, 277—289).—A relation between frequency, sound velocity, and absorption in liquids is derived. It is similar to that for gases, and compares favourably with the experimental results for 12 liquids. Temp. variations and the mixing of liquids are considered. The apparent observed absence of sound dispersion is explained. H. C. G.

Reflexion from crystals in the far ultra-violet. G. RATHENAU (Physica, 1938, 5, 417—426).—Light of λ 2350—1550 A. has been reflected from crystal surfaces at 45° and the following variations in reflecting power have been observed: $NaNO_3$, pronounced decrease for short λ; calcite, increase as λ decreases; $K_4Fe(CN)_6$, min. at $\sim$ 2000 A.; diamond, gypsum, and S, no marked variation. T. H. G.

Ultra-violet dispersion in water (6—35°). M. BAYEN (Compt. rend., 1938, 206, 1254—1256).—An improved apparatus (cf. A., 1936, 409) has been used to measure the dispersion of distilled H_2O between 2500 and 5893 A. The results are compared with those of other observers and expressions for n = function (t) and n = function (λ) are given. J. A. D.

Refractive index and dispersion of distilled water for visible radiation, at temperatures 0° to 60°. L. W. TILTON and J. K. TAYLOR (J. Res. Nat. Bur. Stand., 1938, 20, 419—477).—The refractive index, n, of H_2O has been determined by the min. deviation method to within ± 1 or 2×10^{-6} from 0° to 60° and for λ 7000—4000. The data were adjusted by least squares and are represented by a general formula having 13 consts. A table of n against temp. and λ gives data to 6 decimal places by linear interpolation. The max. val. of n is near 0° and varies by $\sim 0{\cdot}5°$ for different $\lambda\lambda$. D. F. R.

Nature of heat vibrations at very low temperatures. F. MICHAUD (J. Chim. phys., 1938, 35, 99—109).—Theoretical. Entropy pressure is defined by $P_1 = \mathrm{d}w/\mathrm{d}v$, where w is the work involved in varying the vol. v of a system containing a const. quantity of entropy. Vals. of P_1 at 50—298·1° K. have been calc. from published data for Ag, Al, C, Ca, Cd, Cu, Pb, and Tl; the vals. $\propto$ (abs. temp.)^4. The velocity of heat vibrations at very low temp. is equal to that of transverse mechanical vibrations. E. S. H.

Thermodynamic temperature scale below 1° K. W. JACYNA, L. MALIS, and A. OBNORSKY (Bull.

Acad. Polonaise, 1938, **A**, 33—36; cf. A., 1938, I, 72).—Comparative notes on the thermomagnetic and thermodynamic scales, with crit. remarks on previous treatments (A., 1934, 1061; 1935, 1217; 1936, 930; 1937, I, 231). I. McA.

Low-temperature studies. III. Low-temperature calorimeter. Heat capacity and entropy of thallium from 14° to 300° K. J. F. G. Hicks, jun. (J. Amer. Chem. Soc., 1938, **60**, 1000—1004; cf. A., 1937, I, 634).—Apparatus and procedure are described. Heat capacity data for Tl are recorded; the calc. entropy at 298·2° K. is 15·35±0·05 e.u. E. S. H.

Transformations of solid CD_4 and of its mixtures with CH_4. E. Bartholomé, G. Drikos, and A. Eucken (Z. physikal. Chem., 1938, **B**, **39**, 371—384).—The mol. heat of condensed CD_4 was measured from 20° to 30° K.; peaks in the C_p–T curve occur at 21·9° and 26·95° K. The heats of transformation are 25±2 g.-cal. and 51±3 g.-cal., respectively. The corresponding val. for CH_4, which has only one transition point, is 15·7 g.-cal. The heat of fusion of CD_4 is 213±3 g.-cal. per mol. Data for CH_4–CD_4 mixtures are recorded. In mixtures the 26·95° peak for CD_4 is shifted linearly by CH_4 additions until the val. for pure CH_4 (20·6° K.) is attained. The val. of the lower transition temp. is also depressed by CH_4 additions but the peak in the curves disappears with >85% of CH_4. H. J. E.

Recalescence in uranium. W. L. Hole, R. Wright, and H. B. Wahlin (Physical Rev., 1938, [ii], **53**, 768).—A double recalescence, resembling that in Fe at the β–γ transition, has been observed. It indicates changes in the crystal structure of U at about 600° and 800°. N. M. B.

Ounce mol. wt. of a gas. H. D. H. Drane (Nature, 1938, **141**, 791—792).—Attention is directed to the fact that an oz. mol. wt. of a gas occupies 22·4 cu. ft. at 0° and 760 mm. L. S. T.

Acceptability of theoretical and applied thermodynamics in the light of the modern atomic theory. J. J. van Laar (Chem. Weekblad, 1938, **35**, 351—363).—Classical thermodynamical expressions are critically reviewed. D. R. D.

Theory of condensation. B. Kahn and G. E. Uhlenbeck (Physica, 1938, **5**, 399—416).—Mayer's theory of condensation is discussed and shown not to be confined to classical statistical mechanics. Assumption of the additivity property of intermol. forces is not essential. The analogy between Mayer's theory for the condensation of a non-ideal gas and Einstein's theory for an ideal Bose gas is revealed. Assuming certain properties of a function representing the behaviour of a real gas, a rigorous derivation of the condensation phenomenon is deduced. T. H. G.

Critical phenomena in gases. II. Vapour pressures and boiling points. J. E. Lennard-Jones and A. F. Devonshire (Proc. Roy. Soc., 1938, **A**, **165**, 1—11; cf. A., 1938, I, 130).—A direct calculation is made of b.p. in terms of interat. forces. The results for Ne, A, and N_2 are in agreement with observation. A theoretical foundation for Trouton's rule is established. G. D. P.

Theory of measurement of viscosity and slip of fluids by the oscillating-disc method. G. E. Macwood (Physica, 1938, **5**, 374—384).—The theory is extended to fluids of all densities and viscosities which exhibit slip. Two special cases, which together cover all possibilities, are considered. The end correction is discussed and found to be negligible for liquid He and gases at low temp. The fluid motion must not be turbulent. T. H. G.

Elastic constituent of rubber. T. C. Roberts (Nature, 1938, **141**, 834).—*X*-Ray examination of specimens of freshly prepared, unstretched caoutchol (I) (A., 1938, II, 150) at 35° shows certain sharply-defined rings identical with those reported (A., 1937, I, 351) for "frozen" rubber. Other rings show significant differences. At 700% extension (I) gives an *X*-ray diagram almost identical with that obtained from stretched, air-dried, fresh latex, with the transition from the Debye-Scherrer rings to the sharply-defined spots of the fibre pattern clearly visible. The purified rubber hydrocarbon, caoutchene, does not give the rings characteristic of (I), not can it be extended sufficiently to give the fibre characteristic of stretched rubber. (I) is thus the primary factor in the elasticity of rubber. L. S. T.

Theory of initial plastic deformation. V. A. Shdanov (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 815—821; cf. Taylor, A., 1934, 950).—Mathematical. Initial plastic deformation of a solid is assumed to be due to a local transition from periodic to aperiodic particle motion (through external and thermal forces) with an activation energy E depending on the m.p. E is low where van der Waals energy is high, explaining high plasticity in AgCl, TlCl, and not in alkali halides. A formula analogous to Orowan's (A., 1934, 949) relating shearing stress, E, and temp. agrees with experiment for Cd and Zn. E is discussed in relation to melting; in amorphous substances it is a continuous function of temp., hence softening should occur. I. McA.

Present state of the problem of hardness. V. D. Kuznetzov (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 751—784).—A review of the conception and the varied physical properties involved in its measurement by current methods, with suggestions for research. I. McA.

Determination of self-diffusion in solid hydrogen from the course of the *ortho–para*-hydrogen transformation. E. Cremer (Z. physikal. Chem., 1938, **B**, **39**, 445—464).—A theoretical treatment is given for the rate of conversion of *ortho*- into *para*-H in the solid phase for the cases when the mols. do and do not diffuse. From a comparison with experiment the coeffs. of self-diffusion at 11·3—13·6° K. are calc. The activation energy for the interchange of positions of 2 mols. in solid H is 791±130 g.-cal. Corr. vals. for the velocity coeff. of the *ortho–para*-H conversion in the solid phase are given. H. J. E.

Diffusion in a centrifugal field of force. W. J. Archibald (Physical Rev., 1938, [ii], **53**, 746—752).—Mathematical. The general equation for the settling

of particles and mols. in a liquid suspension or ideal solution in a centrifuge has been solved for the case of a sector-shaped cell extending to the centre of the centrifuge. Curves are given which show the concn. at all points in the cell for different vals. of the time. N. M. B.

Thermal conduction in hydrogen–deuterium mixtures. C. T. ARCHER (Proc. Roy. Soc., 1938, **A, 165**, 474—485).—The hot-wire method is used to measure the thermal conductivity of H_2, and D_2, and mixtures of the two gases. The apparatus and method of prep. of the gases are described. The accommodation coeffs. of H and D relative to Pt at 0° are evaluated. G. D. P.

Density of aqueous solutions of hydrochloric acid. G. ÅKERLÖF and J. TEARE (J. Amer. Chem. Soc., 1938, **60**, 1226—1228).—Equations for calculating d at arbitrary concns. and temp. have been derived and used to compute a table for solutions containing 0—38 wt.-% of HCl at 0—80°. E. S. H.

Dipole interaction in mixtures of water with methyl, ethyl, and *n*-propyl alcohols, and of ethyl alcohol with *n*-heptane. A. R. MARTIN and A. C. BROWN (Trans. Faraday Soc., 1938, **34**, 742—748; cf. A., 1937, I, 127).—A linear relation between $-\log a/N$ (a = activity, N = mol. fraction of H_2O) and $(\epsilon-1)/(2\epsilon+1)$ is shown by mixtures of H_2O with MeOH, EtOH, and Pr$^{\alpha}$OH except at vals. of N (>0·9 for EtOH, >0·6 for Pr$^{\alpha}$OH) at which the influence of the pseudo-cryst. structure of H_2O is apparent. The relation holds over the whole range for EtOH in n-C_7H_{16}. It is inferred that in these mixtures the deviations from Raoult's law of the partial v.p. of H_2O (or polar component) are accounted for by dipole interaction. F. L. U.

System cobalt–zinc. J. SCHRAMM (Z. Metallk., 1938, **30**, 10—14).—The system has been examined up to 55% Co by thermal and X-ray analysis; the following intermediate phases exist: β (apparently body-centred cubic), stable only at high temp. and converted into β_1 (cubic β-Mn lattice with 20 atoms in unit cell) below 924°; Γ (with a γ-brass structure and 52 atoms in unit cell), and δ, δ_1, and ζ (formed by various types of distortion from Γ). The homogeneity range at 20° of β_1 is 41—49·5% Co, of Γ 13·5—23% Co, of δ_1 10·5—11·5% Co, and of ζ 6·6—8·2% Co. Peritectic horizontals occur at 966° (γ + liquid $\rightleftharpoons$ β, 34—49% Co), at 895° (β_1 + liquid $\rightleftharpoons$ Γ, 31—46% Co), at 746° (Γ + liquid $\rightleftharpoons$ δ, 6—14% Co), and at 566° (δ_1 + liquid $\rightleftharpoons$ ζ, 2—9·5% Co), peritectoid horizontals at 925° (γ + β $\rightleftharpoons$ β_1) and at 690° (Γ + δ $\rightleftharpoons$ δ_1) and the eutectic horizontal at 419° (0·02—6·6% Co); in addition there are horizontals at 924° and 675° along which the reactions β $\rightleftharpoons$ β_1 + liquid and δ = δ_1 + liquid take place respectively. Zn dissolves only 0·02% Co and the eutectic contains 0·09% Co. A. R. P.

***X*-Ray study of the superlattice in certain alloys.** E. A. OWEN and I. G. EDMONDS (Proc. Physical Soc., 1938, **50**, 389—397).—An investigation of superstructures in the β-phases of Ag–Zn and Au–Zn alloys under various heat-treatments shows that in Au–Zn the atoms are in ordered arrangement in quenched specimens and in specimens maintained at temp. up to the m.p., but in Ag–Zn they are so arranged only in quenched specimens. Results are discussed with reference to the Bragg–Williams order–disorder theory. N. M. B.

Heat of formation of non-ferrous metal alloys. O. KUBASCHEWSKI and W. SEITH (Z. Metallk., 1938, **30**, 7—9).—The heats of formation of the various intermetallic compounds of Na with Pb, Bi, Sn, Sb, Hg, and Cd, of Li with Pb, Bi, Sn, and Sb, and of Mg with Pb and Bi have been determined. The heat of formation–composition curves show max. at NaSn, Li_7Sn_2, Na_2Sb, Li_3Sb_2, and $NaHg_2$, and points of inflexion at Na_3Sn, Li_4Sn, LiSn, and Na_3Hg_2; the other compounds in these systems are not shown on these curves. A. R. P.

Widmannstätten structure of aluminium–silver alloys. G. I. PETRENKO and F. A. DERKATSCH (Ukrain. Chem. J., 1938, **13**, 69—79).—Widmannstätten structure can be produced in alloys with 40—80% Al by heating at 380—400° for a time which is inversely ∝ degree of saturation of the solid solutions. When these are highly unsaturated (40—45% Al) the alloys have to be heated for a short time at the sintering point, and then at 400°, in order to develop the structure. R. T.

Stereomagnetism. IV. Magnetic linking. O. VON AUWERS (Wiss. Veröff. Siemens-Werken, 1938, **17**, Part 2, 74—93; cf. A., 1937, I, 606).—A relation between Curie temp. and magnetic moment for binary alloys is derived from published data. The magnetic properties of the Heusler alloys are discussed, with special reference to the influence of heat-treatment. E. S. H.

***X*-Ray and microscopic investigations on the equilibrium diagram of the aluminium–magnesium–cadmium system.** K. RIEDERER (Z. Metallk., 1938, **30**, 15—16).—Alloys of a composition approximating to Mg_2Cd in which part of the Mg is replaced by Al have a hexagonal structure a 3·12 A., c/a 1·63, in which some of the atoms are displaced from their true position; the lattice closely resembles that of the binary compound $MgCd_2$ but is stable only in the presence of Al. A ternary equilibrium diagram of the system at 230° is given showing the two- and three-phase regions and the range of immiscibility. A. R. P.

Alloys of iron, copper, and molybdenum. W. DANNÖHL (Wiss. Veröff. Siemens-Werken, 1938, **17**, Part 2, 1—13).—The ternary equilibrium diagram has been determined by means of thermal analysis and microscopical examination. E. S. H.

Composition of minima in binary systems of the solid solution type. M. HARA (Nature, 1938, **141**, 873—874).—For the completely isomorphous binary systems investigated, the composition of the metals at the min. on the f.-p. curve corresponds with a simple at. ratio, *e.g.*, Au_3Cu_2, Au_3Ni_2, RbCs, Rb_2K, PdFe (?), PdCo, $PtCo_3$ (?), $FeNi_2$, Fe_3Cr, Fe_2V, and Sb_4As. L. S. T.

Solubility and factors influencing it. H. G. TRIESCHMANN (Z. physikal. Chem., 1938, **B**, **39**, 218—245).—Data are recorded for the solubility of acet-

anilide at 17° in MeOH, EtOH, Pr$^{\alpha}$OH, Pr$^{\beta}$OH, Bu$^{\alpha}$OH, Bu$^{\beta}$OH, Bu$^{\gamma}$OH, *n*-C_6H_{13}·OH, PhCl, $COMe_2$, Et_2O, C_6H_{14}, CCl_4, C_6H_6, dioxan, and H_2O, and in binary mixtures of the alcohols with C_6H_6, C_6H_{14}, CCl_4, and dioxan. The solubility in each case passes through a max. as the composition of the binary solvent mixtures is varied. Further data are given for the solubility in mixed alcohols, and in mixtures of PhCl, Et_2O, or $COMe_2$ with C_6H_6, CCl_4, or C_6H_{14}. Comparative data for quinol are given. The contributions of dipole moments and of residual valencies in determining the observed solubilities are discussed. H. J. E.

Reciprocal solubility in water of boric acid with KH_2PO_4, NaH_2PO_4, KH_2AsO_4, and NaH_2AsO_4. Borophosphates and boroarsenates. IV. G. R. Levi and A. Aguzzi (Gazzetta, 1938, **68**, 179—184).—The ions H_2PO_4' and H_2AsO_4' greatly increase the solubility of H_3BO_3 due to the formation of complex borophosphates and boroarsenates. Solubility data for KH_2PO_4 and NaH_2AsO_4 at 0°, 25°, and 50° are recorded. O. J. W.

Distribution of diethyl tartrate between ether and aqueous borate solution. Equilibrium of boro-diol complex formation. Y. Tsuzuki (Bull. Chem. Soc. Japan, 1938, **13**, 337—349).—The partition coeff. of [·CH(OH)·CO_2Et]$_2$ between Et_2O and H_2O is $c_2/c_1 = 2{\cdot}22$ at 20° and is independent of concn. Solutions of $Na_2B_4O_7$ or KBO_2 give much higher coeffs. which increase with dilution. Study of the equilibrium of the complex formed in the aq. phase indicates the co-existence of compounds of the mono-diol and di-diol types. The complex formation is exothermic and the heat of formation is calc. The distribution is little affected by boric acid. F. L. U.

Adsorption of vapours at plane surfaces of mica. I. D. H. Bangham and S. Mosallam (Proc. Roy. Soc., 1938, **A**, **165**, 552—568).—The adsorption isotherms of C_6H_6, CCl_4, and MeOH on mica (muscovite) have been studied. At low pressures the isotherms of C_6H_6 and MeOH agree with the theoretical equation for films of mobile mols. oriented end-on to the surface. The isotherms of CCl_4 show a series of discontinuities indicating a strong tendency for the mols. to cluster together under the influence of intermol. attractive forces. G. D. P.

Oscillography of adsorption phenomena. III. Rates of deposition of oxygen on tungsten. M. C. Johnson and A. F. Henson (Proc. Roy. Soc., 1938, **A**, **165**, 148—160; cf. A., 1937, I, 436).—An experimental arrangement is described whereby the O_2 pressure at the surface of a W filament is made to rise from zero to a const. val. The rate of primary adsorption and its dependence on pressure and temp. are measured before the monolayer becomes sufficiently dense to allow oxidation and thinning of the filament. The adsorption is traced by photographic registration of the fall of electron emission by means of an oscillograph. A condensation const. is obtained and its temp. coeff. implies a heat of activation = 24,000± 3000 g.-cal. per mol. at about 2200° K. The bearing of the observations on theories of activated adsorption is discussed. G. D. P.

Chemisorption on charcoal. X. Hydrolytic adsorption. H. H. Chambers and A. King (J.C.S., 1938, 688—692; cf. A., 1937, 1, 561).—The adsorption of KCl, NaOBz, and methylene-blue on pure sugar C activated at different temp. has been measured. The curves showing adsorption per unit area are continuous, base being adsorbed for activation temp. <500°, and acid for higher temp. No mol. adsorption occurs with KCl. The results as a whole are such as would be expected on the surface oxide theory, but the latter does not account for the fact that all three salts show zero hydrolytic adsorption for C activated at 500°. F. L. U.

Adsorption [of ions] during the precipitation of ferric hydroxide. R. Chevallier and S. Mathieu (Compt. rend., 1938, **206**, 1249—1251).—As a preliminary to a study of the magnetic properties of $Fe(OH)_3$ the behaviour of the $Fe^{\cdot\cdot\cdot}$ ions in $Fe_2(SO_4)_3$ solution with increasing [OH′] has been studied. During pptn., the $Fe(OH)_3$ carries down adsorbed $Fe^{\cdot\cdot\cdot}$ and all the Fe is consequently removed before free OH′ are observed. J. A. D.

Diffusion of mercury on tin foil. K. Prügel (Z. Metallk., 1938, **30**, 25—27).—On placing a drop of Hg on a piece of rolled Sn foil it spreads outwards by diffusion, forming an ellipse the major axis of which lies in the rolling direction; the rate of spreading is const. so long as any liquid Hg remains and thereafter is an exponential function of the time. On raising the temp. spreading is accelerated and the ellipse approaches a circle owing to annealing of the Sn. During the whole process the [Hg] decreases from 15 to 7 at.-% in passing from the centre to the edge of the drop. A. R. P.

Anomalies in surface tension of paraffin chain salts. N. K. Adam and H. L. Shute (Trans. Faraday Soc., 1938, **34**, 758—765).—Very dil. solutions of $C_{16}H_{33}$·SO_3K, R·O·SO_3Na, NMe_3RBr and $NR(C_5H_5)Br$ (R = $C_{12}H_{25}$ and $C_{16}H_{33}$) exhibit a very slow fall of surface tension, the final val. of which is nearly the same as that of more conc. solutions. At a certain crit. concn., which is approx. that at which micelle formation begins to be detectable, the final val. is reached almost at once. A similar acceleration of the attainment of the final val. is produced in the dil. solutions by addition of inorg. salts. The effect is related to ageing of the surface and not of the bulk solution. F. L. U.

Adsorption potentials at polar liquid–liquid interfaces. G. Ehrensvärd and L. G. Sillén (Nature, 1938, **141**, 788—789).—The p.d. observed when two aq. salt solutions are separated by a H_2O-insol. org. liquid are due to an ion adsorption equilibrium between the aq. phases and the interfacial layer, and not to a partition equilibrium of electrolyte at the phase boundaries and stationary diffusion inside the org. liquid. A formula given for the p.d. of each interface agrees with experimental results. Ion adsorption equilibrium p.d. may play a part in taste and smell sensations and in the activity of local anæsthetics. L. S. T.

Properties of detergent solutions. VII. Two-component systems of fatty acids in organic

liquids. VIII. Interfacial activity of long-chain fatty acids and their xylene solutions. J. POWNEY and C. C. ADDISON (Trans. Faraday Soc., 1938, **34**, 625—627, 628—634; cf. A., 1938, I, 191).—VII. Liquidus curves are given for mixtures of $C_{16}H_{33}\cdot CO_2H$ with C_6H_6, xylene, NH_2Ph, and light petroleum, and for oleic and C_{10}, C_{12}, C_{14}, C_{16}, and C_{18} saturated acids with C_6H_6. Ricinoleic and linoleic acids each form a limited miscibility system with C_6H_6.

VIII. Interfacial tension–concn. relations have been determined for oleic acid against aq. Na oleate and Na dodecyl sulphate containing varying amounts of NaOH, xylene–oleic acid mixtures against solutions of Na salts of oleic, ricinoleic, and linoleic acids, and xylene–fatty acid mixtures against H_2O and aq. Na oleate. The results are discussed. F. L. U.

Contact potentials of stearate films on metal surfaces. E. F. PORTER and J. WYMAN, jun. (J. Amer. Chem. Soc., 1938, **60**, 1083—1094).—Contact potentials of *X* films (A., 1938, I, 76) increase with the no. of layers and may attain vals. of many v.; those of *Y* films are independent of the no. of layers and remain at a few hundred mv. Sudden, large jumps of potential can be produced by alternating the deposition of *X* and *Y* films. At room temp. high *X*-film potentials persist for many days. When *Y* films of Ba–Cu stearate are heated at 74—85° the potentials decrease by about 200 mv.; at about 85° their optical thickness decreases. *Y* films of Ca stearate behave similarly whilst *X* films at 115° increase in optical thickness and gradually become opaque, the potentials dropping to near zero. When heated at lower temp. the potentials persist at high vals. *X*-Rays produce large negative potentials with *X* or *Y* films; *Y* films (but not *X*) are discharged easily by dipping in H_2O or heating below the temp. at which the optical thickness changes. Similar results are obtained when the films function as one of the poles in a glow discharge, but either positive or negative potentials can be produced. The results are discussed in relation to theories of film structure. E. S. H.

Effect of drying conditions on the electrokinetic potential [of glass and cellulose nitrate]. K. KANAMARU, T. TAKADA, and K. MAEDA, (J. Cellulose Inst. Tokyo, 1938, **14**, 132—136).—The ζ-potentials of glass in H_2O and of cellulose nitrate in EtOH diminish with increasing duration of contact between solid and liquid. The initial potentials increase and the rates of diminution become more rapid when the material is more intensively dried. W. A. R.

Surface electrification due to the recession of aqueous solutions from hydrophobic surfaces. I. LANGMUIR (J. Amer. Chem. Soc., 1938, **60**, 1190—1194).—The progressively increasing contact potentials observed (A., 1938, I, 76) during the building up of Ca stearate layers appear to be due to a surface charge on the uppermost monolayer. A theory for the potential distribution produced by these surface charges is given. With potential gradients of 3×10^6 v. per cm. the contact potentials are found to increase at a linear rate of 70 mv. per layer if the no. of layers is $>$ a few hundreds. E. S. H.

Viscosity of unimolecular films. D. G. DERVICHIAN and M. JOLY (J. Chem. Physics, 1938, **6**, 226—227; cf. A., 1937, I, 358).—Using a surface viscosimeter of the same type as that employed in the recent work of Harkins, it is found that the surface flow per sec. $\propto$ the difference in pressure and inversely $\propto$ the length of the canal. There is no relation which corresponds with Poiseuille's law. Changes in state in unimol. layers can be followed by the method described. W. R. A.

Tough soap films and bubbles. G. A. COOK (J. Chem. Educ., 1938, **15**, 161—166).—The formation of soap films and bubbles of increased stability has been investigated. The addition of a small, optimum amount of tannin prolongs the life of bubbles obtained from Castile soap + glycerol. Triethanolamine oleate solutions are superior to Castile soap solutions for open-air work. L. S. T.

Complex formation in lipoid films. J. H. SCHULMAN, E. STENHAGEN, and E. K. RIDEAL (Nature, 1938, **141**, 785).—Investigation by two new methods of the area changes in mixed films formed by injecting dil. solutions of cetyl sulphate, digitonin, etc. into the substrate (H_2O) under monolayers of cholesterol etc. shows that the increased area of the film due to penetration of the injected substance is in a simple ratio 1 : 1 or 1 : 2, depending on the structure (ring or chain) of the org. mols. involved. In addition to surface pressure, bulk concn. of the penetrating agent and changes in p_H affect the formation and stability of certain complexes. L. S. T.

Unit of foaminess. J. J. BIKERMAN (Trans. Faraday Soc., 1938, **34**, 634—638).—Apparatus is described in which a measured vol. of air is forced into a liquid through a porous septum. If *V* is the vol. of air introduced in *t* sec., and *v* is the average vol. of the resulting foam, vt/V is a const., independent of the rate of flow of air and of the size and shape of the apparatus, provided the amount of liquid is not too small. This const. is a natural measure of the foaminess of a liquid. Its val. for two specimens of $Bu^{\alpha}OH$ is recorded. F. L. U.

Molecular interaction in monolayers. J. MARSDEN and J. H. SCHULMAN (Trans. Faraday Soc., 1938, **34**, 748—758).—Force–area relations and surface potentials have been determined for monolayers of equimol. binary mixtures of stearic acid, Δ^{α}-*iso*oleic acid, cetyl alcohol, octadecylamine, and Me octadecyl ether. The measurements indicate that the forces between polar groups in mixed films are coulomb forces acting between (1) ions of like sign, (2) ions of unlike sign, (3) ion and dipole, (4) dipole and dipole. Variation of the p_H of the substrate causes changes in lateral adhesion due to changes in the degree of ionisation of polar groups. F. L. U.

Capillary systems. XIX (8). Permeability of coherent and compact material for gaseous and dissolved substances. E. MANEGOLD (Kolloid-Z., 1938, **83**, 146—162; cf. B., 1938, 602).—Data are collected and discussed for the permeability of Pd, Pt, Cu, Fe, Ni, Al, Zn, and Pb for H_2; porous Cu for H_2, CH_4, C_2H_6, N_2, CO_2, *n*-C_5H_{12}, Et_2O, C_6H_6,

and aq. sucrose; agar gels, zeolites, pyrometer tubes, films of linseed oil and of soap for various gases. F. L. U.

Nature of solutions and their behaviour under high pressures. R. E. GIBSON (Sci. Month., 1938, 46, 1—17).—A lecture. F. L. U.

Dialysis and Brintzinger's method of dialysis. W. RATHJE (Ber., 1938, 71, [*B*], 880—890).—Under the influence of osmotic and hydrostatic pressure the vol. of a solution alters during dialysis, thereby causing abnormally large coeffs. of dialysis in determinations of mol. wt. by the dialysis method of Brintzinger. With increase in the difference of concn. the rate of dialysis increases. Determinations of mol. size can be made therefore only when the osmotically active concn. of the comparison material is equal to that of the substance under examination. The rate of dialysis diminishes as the concn. of the external solution increases. This is attributed to increasing association as the concn. increases. H. W.

Measurement of particle size by the *X*-ray method. F. W. JONES (Proc. Roy. Soc., 1938, A, 166, 16—43).—A theoretical treatment of the problem based on observations of the breadth of the diffraction lines on powder photographs is given. The data for colloidal Au indicate particles of dimensions 703 × 176 × 176 A. The effect of variation of particle size in the sample is discussed. G. D. P.

Colloidal silver. I. Ultramicroscopy, properties, and degree of dispersion. R. SPYCHALSKI (Kolloid-Beih., 1938, 47, 321—370).—The prep. of Ag sols by reduction of solutions (Ag 0·001%) of Ag_2O and $AgNO_3$ with N_2H_4,H_2O and N_2H_4,H_2SO_4 is described. Unidisperse and reproducible sols can be obtained from Ag_2O and N_2H_4,H_2O, and from $AgNO_3$ and N_2H_4,H_2SO_4. The degree of dispersion is largely determined by the $[Na_2CO_3]$ present, and is higher with N_2H_4,H_2SO_4 than with N_2H_4,H_2O. The particles can be counted (slit ultramicroscope) with an error of 10—15% if the sols are unidisperse; otherwise very inaccurate results are obtained. Sols made by reducing $AgNO_3$ solutions with P in Et_2O are amicronic and can be used to prepare unidisperse sols of a required particle size in a way precisely similar to Zsigmondy's if $AgNO_3$ (but not Ag_2O) is used as the source of Ag. F. L. U.

Preparations of gold sols for Lange test.—See A., 1938, III, 625.

Stability of dispersions. J. C. CARRUTHERS (Trans. Faraday Soc., 1938, 34, 646—649).—It is pointed out that, in general, org. substances which give stable dispersions in H_2O have a high mol. wt. and low volatility, whilst the converse is true of those which give unstable dispersions. The suggestion that a labile surface layer of mols. may be unable to retain adsorbed stabilising ions is supported by the results of mobility measurements with C_6H_{14} and $C_{18}H_{38}$, the latter having the higher mobility. In mixtures of the two, $C_{18}H_{38}$ can immobilise the surface mols. of C_6H_{14}, so that a mixture with 90% of C_6H_{14} can be emulsified whereas pure C_6H_{14} cannot. F. L. U.

State of solution of soaps. I. Specific volumes of dilute sodium oleate solutions. M. ULMANN (Z. physikal. Chem., 1938, 182, 18—30).—The sp. vols. (v) of 0·005—16·85% aq. solutions of Na oleate show three well-defined regions over which v is a linear function of concn., transition between these regions occurring at about 0·03% and 0·9%. For concns. between these limits solutions show thixotropic behaviour, since shaking the solutions reduces v, the original val. of which returns after a few days. With 1·6% solutions an increase in v occurs during passage from sol to gel. The similarity of this behaviour to that of high org. polymerides (*e.g.*, a cellulose acetate) is discussed. J. W. S.

Influence of ultrasonic waves on viscosity of colloidal solutions. H. FREUNDLICH and D. W. GILLINGS (Trans. Faraday Soc., 1938, 34, 649—660).—A study of the action of ultrasonic waves on a no. of colloidal solutions shows that the η is affected only in such solutions as exhibit structural viscosity. The effect is usually, but not invariably, due to the collapse of cavities, and is reversible in cases where the decrease of η is due to disintegration of the gross structure. With some substances (cotton-yellow) destruction of the individual particles, and with others (Na stearate) condensation of small particles to rod-like aggregates, occurs. Anomalous η is not markedly affected by ultrasonic waves in V_2O_5 or benzopurpurin sols. In gelatin and agar the reduction of η is not entirely prevented by avoiding the collapse of cavities. F. L. U.

Metal soaps and gelation of their paraffin solutions. A. S. C. LAWRENCE (Trans. Faraday Soc., 1938, 34, 660—677).—The prep. and purification of a large no. of metal soaps are described. The following are new: *Be acetate, hexoate, dodecoate, stearate*; *NH_4 hexoate, octoate, stearate, elaidate*; *Na α-bromostearate*; *Pb, Cs, UO_2, Th, $NHEt_2$, triethanolamine stearates*; *Mg oleate*; *Na, K, Rb, Cs hexacosoates*. Soaps at high temp. form (i) isotropic liquids of low η which on cooling may pass through the stages of (ii) highly viscous liquid, (iii) soft cryst., to (iv) hard cryst. One or both the intermediate stages may be omitted. The behaviour of soaps towards paraffin (Nujol) is strictly analogous to their behaviour on heating. Clear solutions are formed at temp. corresponding with stage (i), whilst separation of micro-crystals occurs below the temp. corresponding with (iv). In the intermediate range transparent elastic gels may be formed. Dry alkali metal soaps do not form gels, but pass directly from (i) to (iv). The last mol. of H_2O cannot be removed from them without decomp. Tables are given to show the gelation and transition temp. of the various soaps studied, and the mechanism of gelation is discussed. F. L. U.

Sol–gel transformations. III. Sols, jellies, and curds of sodium oleate. E. HEYMANN (Trans. Faraday Soc., 1938, 34, 689—698; cf. A., 1936, 427).—The sp. vol. of Na oleate solutions at low concns. is equal to, and at higher concns. slightly >, that calc. from the components. The formation of curd, whether by swelling of dry soap in H_2O or from clear jelly, is accompanied by vol. contraction which

is attributed to hydration. There is no vol. change in the transition sol $\rightleftharpoons$ clear jelly. F. L. U.

Properties of dual emulsions. D. F. CHEESMAN and A. KING (Trans. Faraday Soc., 1938, **34**, 594—598).—By suitably varying the manner of shaking together amyl alcohol and H_2O, an oil-in-H_2O or a H_2O-in-oil type of emulsion can be made at will. The relative stability of the two types has been determined when different emulsifying agents are present, and it is shown that the type other than that normally formed with a given emulsifying agent may possess a limited stability, which in one case is > that shown by the usual type. It thus appears that the same agent can in certain cases stabilise both types of emulsion. Similar results are recorded for kerosene–H_2O mixtures. F. L. U.

Isoelectric point of cellulose. Adsorption and swelling. (MME.) J. GAVORET (Compt. rend., 1938, **206**, 1299—1300).—The resistivity of a dil. buffer solution increases on immersion of cellulose, the increase being max. when the p_H of the buffer solution is 2·4—2·8; this is interpreted as the isoelectric point of cellulose (cf. also A., 1937, I, 408), the max. increase at this point being due to the min. swelling capacity, with consequent min. absorption of H_2O. The swelling capacity and adsorptive power increase rapidly for $p_H > 2·8$. A. J. E. W.

Shape and size of methylcellulose molecules in solution, deduced from measurements with the ultracentrifuge and viscosimeter. R. SIGNER and P. VON TAVEL (Helv. Chim. Acta, 1938, **21**, 535—545).—The data for aq. solutions show that methylcellulose mols. of mol. wt. 14,100, 24,300, and 38,100 have a length of 560, 870, and 1190 and a thickness of 7·3, 7·9, and 8·6 A., respectively. Mols. are at most slightly bent and are probably slightly, but only slightly, hydrated. R. S. C.

Diffusion of cellulose derivatives. A. POLSON (Kolloid-Z., 1938, **83**, 172—180).—The diffusion coeff. of cellulose acetate in $COMe_2$ and of methylcellulose (I) in aq. NaCl has been determined by an optical method (A., 1936, 563), using fractions of the latter substance for which the mol. wt. is known from sedimentation equilibrium measurements. The results obtained in the two ways agree. An expression is derived for the influence of swelling pressure on the rate of diffusion. The axial ratio of (I) mols. regarded as ellipsoids of revolution is calc. F. L. U.

Dielectric properties of protein solutions. I. Carboxyhæmoglobin. J. L. ONCLEY. **II. Water-soluble proteins of normal horse serum.** J. D. FERRY and J. L. ONCLEY (J. Amer. Chem. Soc., 1938, **60**, 1115—1123, 1123—1131).—I. Factors determining the dielectric behaviour involve (1) the dielectric increment at low frequencies, $\Delta\epsilon_0/g$, which depends on the difference in polarity between the protein and solvent mols., (2) the dielectric increment at high frequencies, $\Delta\epsilon_\infty/g$, which depends mainly on the vol. and hydration of the protein mols., (3) the crit. frequency, ν_c, which depends mainly on the size and shape of the mols. and the viscosity of the solvent. The determination of these quantities by measurement of ϵ with a radio frequency bridge is described. Results for solutions of cryst. carboxyhæmoglobin are: $\Delta\epsilon_0/g$ 0·33, $\Delta\epsilon_\infty/g$ −0·11, ν_c $1·9 \times 10^6$ cycles per sec., suggesting a dipole moment of about 500 Debye units, and an orienting dipole of mol. wt. 66,700.

II. The dielectric consts. of solutions of pseudoglobulin (I) and several cryst. fractions of albumin from normal horse serum have been determined over a wide frequency range. All these proteins increase the static ϵ of H_2O. The ϵ increments for the serum-albumins increase with increasing solubility in aq. $(NH_4)_2SO_4$; the increment for (I) is much greater. The ϵ increments per g. are of the same order as for NH_2-acids, increasing from 0·1 for the least polar albumin to 1·1 for the (I) (7000—160,000 per mol.). The variation of ϵ increment with frequency for all the albumins deviates only slightly from the theoretical Debye curve with a crit. frequency of 0·85 megacycle. The dispersion of the ϵ increment of the (I) solutions deviates slightly from a Debye curve with a crit. frequency of 0·24 megacycle. The relaxation times calc. from these crit. frequencies are $\gg$ would be calc. from the mol. wts. on the basis of present theories. E. S. H.

Alginic acid. I. Constitution. G. LUNDE, E. HEEN, and E. ÖY. **II. X-Ray study of spun threads of alginic acid.** H. KRINGSTAD and G. LUNDE. **III. Viscosimetric determination of mol. wt.** E. HEEN (Kolloid-Z., 1938, **83**, 196—202, 202—203, 204—210).—I. Analysis of carefully purified alginic acid and of its Na salt confirms the view that the chemical unit is mannuronic acid anhydride and not the acid itself.

II. Fibre diagrams of stretched threads of Na alginate disclose orientation and render it probable that the acid has a structure similar to that of cellulose.

III. The sp. η of solutions of alginic acid is a max. at p_H 7 and reaches a const. val. in about 2N-NaOH. The mol. wt. calc. by Staudinger's formula corresponds with a chain length of about 80 hexuronic acid units. F. L. U.

Liesegang rings and related phenomena. Material nature of light. C. SCHUYTEN (Rev. gén. Sci., April 15, 1938, Reprint, pp. 3—14).—Observations of the growth of discs and rings of Ag_2CrO_4 indicate that these represent the final stage of a spiral rather than a discontinuous process. This accounts for the anastomoses generally visible in a ring system formed in a flat dish. The similarity of pattern shown by Liesegang rings, rings formed by evaporating solutions of solids, and Newton's rings is held to be due to a common cause. F. L. U.

Precipitation of tricalcium phosphate by urease.—See A., 1938, III, 615.

Growth of metal trees in gels. I. Morphology of lead tree. A. KING and N. STUART (J.C.S., 1938, 642—654).—Growth of arboreal structures of Pb in SiO_2 gels containing $Pb(OAc)_2$ is induced by reduction with Sn, Zn, Al, Mg, Mn, Cr, Cd, Fe, and Cu, but not with Co or Ni. $Pb(NO_3)_2$ is not reduced by Sn under these conditions, nor is $Pb(OAc)_2$ reduced by Sn in SiO_2 sol before the occurrence of gelation. Sn produces widely different types of growth depending on the concn. of Pb in the gel. Other colloidal

materials inhibit or modify the growth in an unpredictable manner. F. L. U.

Theory of structure viscosity. III. Flow of plastic substances. W. PHILIPPOFF (Kolloid-Z., 1938, **83**, 163—172; cf. A., 1936, 788).—The η and fluxional birefringence of a no. of liquids have been studied in capillary tubes of various diameters. Na oleate (33%) and 2 days old V_2O_5 sol exhibit stationary laminar flow. V_2O_5 sol aged for 1 year behaves abnormally on account of the presence of "swarms" which are broken up only at high rates of shear. Cellulose acetate in $CH_2Ph{\cdot}OH$ and an oil paint (50% ZnO in linseed oil varnish) show non-laminar flow in consequence of slipping at the wall of the capillary. The anomalous flow of sols of mercurisulphosalicylic acid and cotton-yellow is due to gross heterogeneity caused by the breaking up and syneresis of masses of gel. It is possible to distinguish between ordinary non-Newtonian liquids, disintegrated gels, cybotactic sols, and conc. suspensions only by experiments with capillaries of varying dimensions, since the flow characteristics of the last three systems are not independent of the apparatus dimensions. F. L. U.

Adhesion of particles of microscopic size. VII. Adhesion of barium sulphate particles in electrolyte solutions. A. VON BUZÁGH and Z. SZABÓ (Kolloid-Z., 1938, **83**, 139—146; cf. A., 1936, 1064).—The adhesion of particles of $BaSO_4$ in homogeneous dispersions has been measured by the tilting-plate method in H_2O and electrolyte solutions. In H_2O the adhesion is a min. for particles of about 5 μ. radius, and approaches a limit beyond 30 μ. The influence of electrolytes on adhesion is exactly parallel with their influence on the electrokinetic behaviour, in the sense that the adhesion is greatest when the mobility is least. The usual lyotropic effects are observed. $Ba^{\cdot\cdot}$ and SO_4'' ions exert an exceptionally large influence. F. L. U.

Reaction isotherm. A. BANCHETTI (Gazzetta, 1938, **68**, 192—195).—Various methods of calculating the max. work obtainable from an isothermal reaction by means of the van 't Hoff equilibrium box are discussed. O. J. W.

Limits of applicability of the Gibbs–Helmholtz equation and derivation of a general equation valid for cells which operate either reversibly or irreversibly and with the volume either constant or variable during operation. O. SCARPA (Gazzetta, 1938, **68**, 113—117).—A general expression for the e.m.f. of an electrochemical cell is derived. For the case of a reversible process and const. vol. this expression becomes identical with the Gibbs–Helmholtz equation. O. J. W.

Energy relations in aqueous solutions of inert gases. E. LANGE and R. WATZEL (Z. physikal. Chem., 1938, **182**, 1—17).—Theoretical. The energy changes involved during dissolution of a gas in H_2O are discussed, and, from solubility data, thermal and entropy changes for solutions of He, Ne, A, Kr, Xe, and Rn in H_2O at various temp. are deduced. J. W. S.

Dissociation of nitric acid. O. REDLICH (Z. physikal. Chem., 1938, **182**, 42—47; cf. A., 1936, 799).—New measurements of the variation in the intensity of the strongest NO_3' line in the Raman spectrum of HNO_3 at various dilutions (A., 1937, I, 598) lead to a val. of the dissociation const. of HNO_3 which agrees with vals. deduced from the absorption spectrum of HNO_3 (A., 1928, 590) and from the influence of HNO_3 on the absorption spectrum of 2 : 4-dinitrophenol (A., 1938, I, 81). It is inferred that the divergencies reported are not due to ionic hydration but are attributable to some sp. effect of $H^{\cdot}$ other than formation of undissociated HNO_3 mols. J. W. S.

[Dissociation of nitric acid.] H. VON HALBAN and M. SEILER (Z. physikal. Chem., 1938, **182**, 48; cf. A., 1938, I, 81, and preceding abstract).—The views of the authors and of Redlich are now reconciled. J. W. S.

Dissociation relationships of disubstituted succinnic acids.—See A., 1938, II, 216.

Dissociation constants of acids in mixtures of light and heavy water. P. GROSS (Z. Elektrochem., 1938, **44**, 299—301).—Theoretical. It is shown that the assumptions made by Schwarzenbach (A., 1938, I, 139) can be deduced from the treatment of Gross *et al.* (A., 1936, 802). F. J. G.

Acid dissociation constants in dioxan–water mixtures by potentiometric titration. C. C. LYNCH and V. K. LA MER (J. Amer. Chem. Soc., 1938, **60**, 1252—1259).—The dissociation consts. of AcOH, $EtCO_2H$, $PrCO_2H$, and BzOH have been determined by potentiometric titration in dioxan–H_2O mixtures of dielectric const. 34·3, 21·0, and 11·7, respectively. Addition of LiCl was found necessary for adequate conductivity but by determining the dissociation consts. in presence of progressively decreasing [LiCl] and extrapolating to zero, vals. for the mixed solvent without added neutral salt have been obtained. The logs of the extrapolated consts. (except for BzOH) are linear functions of the reciprocal of the dielectric const. from 78 to 21. Weak acids, insol. in H_2O (*e.g.*, abietic and stearic acids), can be titrated directly in 80% dioxan. E. S. H.

Slow hydrolysis of ferric chloride in dilute solution. II. Change in hydrogen-ion concentration. A. B. LAMB and A. G. JACQUES (J. Amer. Chem. Soc., 1938, **60**, 1215—1225; cf. A., 1938, I, 312).—The change in $[H^{\cdot}]$ has been followed by measurements with the glass electrode. The results support the conclusions previously derived from measurements of conductance and colour. Calculations have been made of the first and second hydrolysis consts. of $FeCl_3$ and of the relative amounts of unhydrolysed as well as partly and completely hydrolysed salt over a wide range of concn. Undissociated $Fe(OH)_3$ is the only substance which increases in concn. with decreasing over-all concn. of the salt. It is deduced that the primary product of hydrolysis is a dil., supersaturated solution of $Fe(OH)_3$, the coagulation of which to colloidal particles is the controlling, relatively slow, step of the reaction. In the initial stages of slow hydrolysis, where the speed of hydrolysis is limited by the rate of formation of

nuclei, the speed $\propto [Fe(OH)_3]^2$, in accordance with the Smoluchowski theory of rapid coagulation. E. S. H.

Equilibrium $Pb + SnBr_2 \rightleftharpoons PbBr_2 + Sn$ in aluminium bromide as solvent. J. K. Delimarski (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 443—458).—In the above reaction at 360° Sn is considerably nobler than Pb. Owing to complications introduced by the solvent, the observed equilibria do not agree with those calc. from the apparent active masses. F. L. U.

Gas–liquid equilibrium for the system methane–butane. G. W. Nederbragt (Ind. Eng. Chem., 1938, 30, 587—588).—The mol. fraction ratios for CH_4 and n-C_4H_{10} in the gas and liquid phases have been determined. The vals. at 10 atm. are 12·8 and 0·082 at −16·5°, 16·6 and 0·22 at 16°, 20·0 and 0·44 at 38°; at 20 atm., 6·7 and 0·049 at −21°, 8·6 and 0·14 at 17°, 10·1 and 0·25 at 39°; at 30 atm., 4·8 and 0·049 at −18°, 5·6 and 0·12 at 14·5°, 6·6 and 0·22 at 43°. The vals. for CH_4 agree approx. with published vals. for mixtures of CH_4 with C_3H_8 (A., 1934, 490; B., 1934, 949), and with C_5H_{12}, C_6H_{14}, and C_7H_{16} (A., 1936, 1333; B., 1936, 1076), whence it is inferred that they will also apply to natural gasolines since these are mixtures of lower paraffins. R. C. M.

Thermal studies of binary and ternary mixtures. I. Binary system acetanilide–phenacetin. G. Ulisse (Boll. Chim. farm., 1938, 77, 212—214).—The m.p. curve of NHPhAc (I)–phenacetin mixtures shows a max. corresponding with a 4 : 1 mol. compound [75% of (I)]. This compound forms a binary system with (I), yielding a eutectic mixture, m.p. 83°, containing 76·4% of (I). F. O. H.

System As_2O_5–BaO–H_2O at 17°. Characterisation of a new barium arsenate, $BaO,2As_2O_5,3H_2O$. H. Guérin (Compt. rend., 1938, 206, 1300—1303; cf. A., 1926, 358; 1937, I, 474).—A ternary diagram for the system is discussed. The compounds $Ba_3(AsO_4)_2,xH_2O$, $Ba_2H_2(AsO_4)_2,2H_2O$, $BaH_4(AsO_4)_2,H_2O$, $BaH_4(AsO_4)_2$ (I), and $BaO,2As_2O_5,3H_2O$ (II) occur as solid phases, (II) being formed from (I), which occurs only in false equilibrium. A. J. E. W.

System $Na_2HPO_4 + 2NH_4Cl \rightleftharpoons (NH_4)_2HPO_4 + 2NaCl$. R. Lauffenburger and M. Brodsky (Compt. rend., 1938, 206, 1383—1385).—Equilibrium diagrams for the system at 0° and at 25° are given. $NaNH_4HPO_4,4H_2O$ has the largest region of stability at these temp. A. J. E. W.

Ternary systems. XXIII. Solid solution among the picromerite double salts at 25°. Zinc, copper, and nickel ammonium sulphates. A. E. Hill and W. J. Taylor, jun. (J. Amer. Chem. Soc., 1938, 60, 1099—1104; cf. A., 1938, I, 252).—The systems $ZnSO_4$–$(NH_4)_2SO_4$–H_2O and $NiSO_4$–$(NH_4)_2SO_4$–H_2O have been investigated at 25°. The formation of solid solutions between pairs of the salts $CuSO_4,(NH_4)_2SO_4,6H_2O$, $ZnSO_4,(NH_4)_2SO_4,6H_2O$, and $NiSO_4,(NH_4)_2SO_4,6H_2O$ has been studied, and the equilibrium distribution of salts between liquid and solid solutions determined. The mol. concns. in the liquid and solid phases are related approx. by an exponential equation, in which the exponent approaches 1 when the aq. solubilities of the salts are equal and diminishes as the ratio of the solubilities increases. E. S. H.

Binary and ternary solutions of nitrates in anhydrous acetic acid. A. W. Davidson and H. A. Geer (J. Amer. Chem. Soc., 1938, 60, 1211—1214).—Solubility data are recorded for $LiNO_3$ in AcOH at 39—132°, and for $Ca(NO_3)_2$ at 30—34°. The isolation of $Ca(NO_3)_2,3AcOH$ is reported. Solubility data for the systems $AgNO_3$–NH_4NO_3–AcOH at 40—90° and $AgNO_3$–$LiNO_3$–AcOH at 30° are recorded; in the former system $AgNO_3,NH_4NO_3$ occurs as a stable solid phase over a small concn. range. E. S. H.

Relative partial molal heat content of sodium bromide in aqueous solutions at 25°. A. L. Robinson (J. Amer. Chem. Soc., 1938, 60, 1265).—Data calc. from e.m.f. measurements (A., 1937, I, 617) are in fair agreement with those derived from calorimetric measurements (A., 1932, 998). E. S. H.

Free energy of acetylene. A. R. Gordon (J. Chem. Physics, 1938, 6, 219—220).—The free energy of C_2H_2 has been calc. from spectroscopic data. Equilibrium consts. have been evaluated for the reactions: $2C + H_2 = C_2H_2$; $C_2H_2 + N_2 = 2HCN$. W. R. A.

***A priori* calculation of the calorific power of hydrocarbons.** M. Brutzcus (Compt. rend., 1938, 206, 1291—1294; cf. A., 1937, I, 364).—General formulæ for the calculation of the calorific power of any hydrocarbon are given, and their agreement with experimental data is demonstrated. A. J. E. W.

Heats of sublimation. K. L. Wolf and H. Weghofer (Z. physikal. Chem., 1938, B, 39, 194—208).—Heats of sublimation for 55 and heats of fusion for 3 org. substances are recorded. Data for isomeric substances are compared. The heat of sublimation cannot in general be treated as the sum of the contributions of all the atoms and groups in the mol. Additivity is observed in certain cases, *e.g.*, for C_6H_6, $C_{10}H_8$, and $C_{14}H_{10}$. Factors which influence the val. of the heat of sublimation are discussed. H. J. E.

Thermal data. IX. Heats of combustion of hippuric and succinic acids and a proposal for the use of hippuric acid as a secondary standard in combustion calorimetry. H. M. Huffman (J. Amer. Chem. Soc., 1938, 60, 1171—1177).—The isothermal heats of combustion of succinic and hippuric acids at 25·0° are 3023·1 and 5628·6 g.-cal. per g., respectively. Heats of formation are calc. The use of hippuric acid, cryst. from H_2O, as a secondary standard is proposed for investigations on compounds containing N. E. S. H.

Heats of combustion, refractive data, and alkaline hydrolysis of the ethyl *cis*-pentenoates. —See A., 1938, II, 258.

Electrochemical study of antimony trichloride in chlorobenzene and nitrobenzene solutions of aluminium bromide. E. J. Gorenbein (J. Gen.

Chem. Russ., 1938, 8, 233—240).—Sp. conductivity κ rises in the system $SbCl_3$–$AlBr_3$–PhCl with increasing concn. of the complex $SbBr_3$,$AlBr_3$ (I). In $PhNO_2$ κ is max. when the concn. of (I) is 32%. Mol. conductivity in PhCl falls, and in $PhNO_2$ rises, with increasing dilution. Sb is deposited at the cathode, at a decomp. potential of 1·02 v. (in PhCl). The reaction $AlBr_3 + SbCl_3 \rightleftharpoons AlCl_3 + SbBr_3$ is established. R. T.

Electrochemical study of systems $AlBr_3$–EtBr and $AlBr_3$–EtBr–KI. I. L. KATZNELSON (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 393—404).—The sp. conductivity (κ) of $AlBr_3$–EtBr mixtures is a max. for $AlBr_3$/EtBr = 0·66. The decomp. potential is 1·98 v. Addition of KI increases κ, the increase showing a max. at a certain $AlBr_3$/EtBr ratio. Electrolysis leads to deposition of Al and I with a current yield of 80% at the cathode. The decomp. voltage, 1·28, exceeds the calc. by 0·26 v. F. L. U.

Electrochemical properties of melts of LiCl–$AlBr_3$, NaCl–$AlBr_3$, KCl–$AlBr_3$, and AgCl–$AlBr_3$. J. P. MESHENNI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 413—426).—The conductivity of fused $AlBr_3$ increases on the addition of alkali chlorides in proportion to the mobility of the added cation. The temp. coeff. is positive. The decomp. voltage is the same for all the mixtures containing alkali halides. Al is deposited on the cathode. F. L. U.

Electrochemical properties of systems LiCl–$AlBr_3$–EtBr, NaCl–$AlBr_3$–EtBr, KCl–$AlBr_3$–EtBr, and AgCl–$AlBr_3$–EtBr. J. P. MESHENNI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, 4, 427—442; cf. preceding abstract).—The alkali chlorides are sol. in EtBr in presence of $AlBr_3$, their solubility increasing in the order K < Na < Li. The conductivity of the solutions is increased in the order Li < Na < K. Other properties are described. F. L. U.

Theoretical study of ion transport by a current of vapour for the production of high potentials. J. VIRGITTI (Compt. rend., 1938, 206, 1367—1369).—A method suggested for the production of high potentials, involving the collection of charges from a stream of gaseous ions (cf. *ibid.*, 1935, 201, 1332), is shown to be impracticable. A. J. E. W.

Theoretical bases for the electrochemical properties of liquid ammonia. S. MAKISHIMA (J. Fac. Eng. Tokyo, 1938, 21, 115—168).—The author's theory (A., 1935, 1325) is applied to solutions in liquid NH_3. The solubility product law holds for solutions of halides in liquid NH_3, and the vals. of the solubility product, heat of dissolution of gaseous ions, and entropy change during solvation are deduced for a no. of salts. Solubilities in NH_3 are compared with those in H_2O. The normal potentials of metal and halogen electrodes in NH_3 are lower with respect to the H_2 electrode than in H_2O. The effects observed are attributed to chemical, rather than electrostatic, solvation effects. The dissociation const. of NH_3 at −34° is about 5×10^{-31}, and it is deduced that the normal potential of the N_2 electrode is −1·5 v. It is assumed that alkali metals dissolved in liquid NH_3 split into solvated metal ions and electrons, and the solubility product, heat of solvation of electrons, and their entropy are deduced. The blue colour of the solutions is in accord with the view that absorption is due to the solvated electrons. High H_2 and N_2 overpotentials are observed at Pt electrodes during electrolysis in NH_3, and these permit the electrodeposition of metals such as Be, Al, and rare-earth metals, and the occurrence of unusual electrolytic reduction reactions. J. W. S.

Electrochemical behaviour of metals which furnish cations of different valency. II. R. PIONTELLI (Gazzetta, 1938, 68, 173—178; cf. A., 1937, I, 245).—A general expression is derived for the equilibrium const. between a metal and its ions in two valency states. Data for Cu and Ag give good agreement with the theory. O. J. W.

Normal potential of deuterium and ionic equilibria in mixtures of H_2O and D_2O. G. SCHWARZENBACH (Z. Elektrochem., 1938, 44, 302).—A reply to Abel and Redlich (A., 1938, I, 254). Reasons are given for the belief that the cell D_2|DCl in D_2O|KCl (sat.) in H_2O|HCl in H_2O|H_2 gives a closer approximation to the normal potential of D than does the cell D_2|DCl in D_2O|AgCl, Ag, AgCl|HCl in H_2O|H_2. F. J. G.

Meaning and standardisation of the p_H scale. D. A. MACINNES, D. BELCHER, and T. SHEDLOVSKY (J. Amer. Chem. Soc., 1938, 60, 1094—1099).—E.m.f. of cells of the type H_2(Pt)|buffer solution, KCl (sat.), KCl (0·1N), Hg_2Cl_2|Hg have been determined at 12°, 25°, and 38°, and the results interpreted for the purpose of obtaining vals. of E_0 in the equation $p_H = (E - E_0)/(2{\cdot}3026RT/F)$. The p_H vals. of acetate and phthalate buffers have been redetermined at the above temp. E. S. H.

Polarisation of a calomel electrode. (LORD) ROTHSCHILD (Proc. Roy. Soc., 1938, B, 125, 283—290).—Polarisation is defined as the production of a thermodynamically irreversible potential at the surface of an electrode; the difference in polarisability between a calomel and any other type of electrode is one of degree only. Measurement of the p.d. between the electrode being examined and a reference electrode at intervals during the passage of currents of known strengths shows that the max. c.d. which an anodic calomel electrode will sustain over a period of 5 hr. without polarisation is 15 μa. per sq. cm. F. B. P.

Oxidation–reduction potentials in heterogeneous systems. I. M. KORR (J. Cell. Comp. Physiol., 1938, 11, 233—245).—The addition of an adsorbent to a solution of a dye causes a change in the oxidation–reduction potential measured with a Pt electrode. The direction of the change varies with the p_H, depending on whether the oxidant or reductant is adsorbed. Similar differences may be observed with a quinhydrone electrode. It follows that the redox potential at an interface may differ from that existing in the aq. phase. V. J. W.

Electrolytic thermal chains. J. J. HERMANS (Z. physikal. Chem., 1938, 182, 49—53).—The conclusions of Szabó (A., 1938, I, 143) are criticised on

the grounds that activity corrections are only incompletely applied, the relationship with the Peltier heat and the heat of transfer is incorrectly deduced, and that no definite conclusions concerning the ionic activities are possible. J. W. S.

Electrolytic thermal chains. Z. SZABÓ (Z. physikal. Chem., 1938, **182**, 54).—A reply to Hermans (cf. preceding abstract). J. W. S.

Electrolysis of colloidal silver solutions. M. CENTNERSZWER and (MLLE.) J. BOROWICZ (Bull. Acad. Polonaise, 1937, **A**, 530—545).—The particles of dialysed Ag sols prepared (i) by the action of P on ammoniacal $AgNO_3$, (ii) by H_2 reduction of aq. Ag_2O, contain, by ultramicroscopic count, $\sim 10^8$ Ag atoms, having an effective valency from sp. conductivities of 0·53—0·97, a result which is at variance with Pauli's colloid conceptions. Electrolysis between Pt electrodes with accompanying decomp. of H_2O yields, for the (anode-seeking) colloidal Ag, electrochemical equivs. of 3·6—9·8. These vals., and the mechanism whereby dendritic Ag is deposited at the cathode, are discussed. I. McA.

Electrochemistry of rusting process along a scratch-line on iron. R. S. THORNHILL and U. R. EVANS (J.C.S., 1938, 614—621; cf. A., 1936, 36).—Apparatus for the direct measurement of currents near a scratch-line on Fe covered with filter-paper soaked in $NaHCO_3$ solution is described. Simultaneous measurements of the amount of corrosion show the latter to be mainly electrochemical, Fe^{II} compounds being formed in the early stages in amount corresponding roughly with the current. The subsequent oxidation to Fe^{III} compounds is shown to be also electrochemical under the conditions of the experiments. F. L. U.

Polarographic studies of organic compounds. I. TACHI (Mem. Coll. Agric. Kyoto, 1938, No. 42, 2—63).—An account of previous work is given (A., 1937, I, 567, and previous abstracts). Abnormalities in the polarogram of camphor are due to its strong adsorption at the dropping Hg cathode. Of the three waves observed, the second is due to reduction, and the first and third to the formation and destruction of an oriented layer respectively. Reduction of bilirubin occurs in a single stage and requires 2 H atoms. The reduction potential in 2×10^{-4}M solution at 25° is 1·464 v. negative to the N-calomel electrode. The solubility of bilirubin in a p_H 7 buffer is about 9 mg. per l. Polarograms of the air-oxidation product indicate the presence of at least two, the more reducible of which is pptd. at $p_H > 5$ and is regarded as biliverdin. F. L. U.

Polarographic researches on proteins. R. BRDICKA (J. Chim. phys., 1938, **35**, 89—98; cf. A., 1937, III, 205).—Polarographic curves show the presence of maxima on the addition of proteins in the electrolysis of solutions of NH_4 or Co salts. The maxima coincide with the evolution of H_2, which in presence of the protein occurs at a lower overpotential. The effect of the protein is catalytic and associated with the presence of SH radicals. The mechanism of the action is discussed. E. S. H.

Properties of the oxides of nitrogen. VII. Flame propagation in the system dinitrogen pentoxide–ozone. T. M. LOWRY and R. V. SEDDON (J.C.S., 1938, 626—631; cf. A., 1937, I, 521).—NO_3 is shown spectrographically to be present in a mixture of N_2O_5 and O_3 undergoing slow decomp. as well as in the flame front in the explosive reaction. In the slow reaction $-d[O_3]/dt = k[N_2O_5]^{\frac{1}{2}}[O_3]^{\frac{1}{2}}$, the primary reaction being the unimol. decomp. of N_2O_5 to NO_2 and NO_3, followed by the decomp. of O_3 by NO_2, the bimol. decomp. of NO_3, and the reformation of N_2O_5. The same mechanism applies to the flame. For given conditions the plot of log P/T against $1/T$ is a straight line (P = pressure, T = crit. explosion temp.); adiabatic self-propagation is due to the thermal energy liberated in the bimol. trioxide decomp. M. R.

Explosion regions. XXVII. Analogy between propagation of reactions in gas mixtures and that in mixtures of solid substances or in mixtures of gases and solid substances. W. P. JORISSEN (Rec. trav. chim., 1938, **57**, 467—486).—A résumé and discussion of previous results (cf. A., 1936, 32, 431, and earlier abstracts). M. R.

Paramagnetic conversion of para-hydrogen and ortho-deuterium in the presence of nitric oxide. (Magnetic moment of the deuteron.) L. FARKAS and U. GARBATSKI (J. Chem. Physics, 1938, **6**, 260—263).—The rates of the reactions $p\text{-}H_2 + NO \rightleftharpoons o\text{-}H_2 + NO$ (1) and $o\text{-}D_2 + NO \rightleftharpoons p\text{-}D_2 + NO$ (2) are compared. According to Wigner's theory the ratio of the velocities should be $\propto \mu_H/\mu_D$, where μ_H and μ_D are the magnetic moments of H and D. The ratio of the rates is in approx. agreement with Wigner's theory and also with that of Kalckar and Teller; no decision can be made regarding which of these theories is the better approximation. The velocity coeff. for (1) is approx. 10 times that of (2) at the same temp. Comparison of the conversion rates of both reactions with those in presence of O_2 shows that the ratios are the same but that the rates in NO are about 5 times the rates in O_2. Assuming $\mu_H = 2{\cdot}46$ nuclear magnetons and $\mu_H/\mu_D = 3{\cdot}8$, $\mu_D = 0{\cdot}65$ nuclear magneton; this val. is compared with recorded vals. W. R. A.

Activation energy of diene association reactions. M. G. EVANS and E. WARHURST (Trans. Faraday Soc., 1938, **34**, 614—624; cf. A., 1938, I, 145).—Activation energies of diene association are calc. by the diabatic method and by treating the system as a six-electron problem. The latter leads to satisfactory results compared with experimental vals. for the addition of C_2H_4 to butadiene. The failure of the first method and the cause of the abnormal temp.-independent factors of the reactions are discussed. F. L. U.

Velocity of the thermal *cis* → *trans*-conversion of azobenzene and derivatives.—See A., 1938, II, 272.

Thermal decomposition of *n*-octane.—See A., 1938, II, 254.

Stability of free radicals.—See A., 1938, II, 253.

"Acidolysis" of esters. E. CHERBULIEZ and M. FULD (Arch. Sci. phys. nat., 1938, [v], **20**, Suppl., 52—54).—As example of the reaction $RCO_2R' + R''CO_2H \rightarrow RCO_2H + R''CO_2R'$, the velocity with Et acetoacetate can be followed from the amount of CO_2 resulting from the decomp. of the liberated acid. The rate is not a simple function of the strength of $R''CO_2H$ as judged by its ionisation in H_2O; the reaction is catalysed by H_2O and by conc. H_2SO_4, but not by gaseous HCl, this indicating that the mechanism is independent of traces of H_2O. M. R.

Velocity of the reaction: $CH_2Br{\cdot}COO' + S_2O_3'' \rightarrow S_2O_3{\cdot}CH_2{\cdot}COO'' + Br'$, in aqueous organic solvents. L. FILIPCZYK (Rocz. Chem., 1938, **18**, 36—38).—The velocity of the reaction in aq. MeOH varies inversely with the [MeOH] to a concn. of 50%, above which it rises gradually. The activation energy is independent of the [MeOH]. R. T.

Reaction kinetics in films. Active agents in the aqueous halogenation of long-chain phenols. A. E. ALEXANDER (J.C.S., 1938, 729—734).—Measurements of surface pressure and surface potential by monolayer technique applied to *p*-hexadecylphenol on suitable substrates show that with aq. I, Br, and Cl solutions the active intermediates are the hypohalous acids and trihalide ions, activities being in the order HOI > HOBr > HOCl and $I_3' < Br_3' < Cl_3'$. Bulk phase experiments confirm these results. HOCl is approx. 0·001 as active as Cl_3', HOI is 1000 times as active as I_3' and HOBr is 0·25 as active as Br_3'. The equilibrium const. $[Cl_2][Cl']/[Cl_3']$ is 0·23. M. R.

Hydrolysis of sucrose. P. M. LEININGER and M. KILPATRICK (J. Amer. Chem. Soc., 1938, **60**, 1268).—In the inversion of 2% sucrose by HCl at 0—10° the energy of activation varies from 24·2 kg.-cal. at 4·842M-HCl to 26·2 kg.-cal. at 1·1235M-HCl. E. S. H.

Unimolecular rates of hydrolysis of 0·01M-methyl- and -benzyl-fructo-furanosides and -pyranosides and of sucrose in 0·00965M-hydrochloric acid at 20—60°. L. J. HEIDT and C. B. PURVES (J. Amer. Chem. Soc., 1938, **60**, 1206—1210).—The hydrolysis was determined by means of the Shaffer–Hartmann–Somogyi alkaline Cu reagent. The unimol. rate coeffs. k at 20—60° have been determined, and are in accordance with: $\log k = \log a - b/T$. The activation energies E are: α- and β-methyl- and β-benzyl-fructopyranoside 28·2, 29·9, 28·1 kg.-cal., α-methyl- and α-benzyl-fructofuranoside 27·0, 25·2 kg.-cal., sucrose 25·7 kg.-cal. The consts. $\log a$, b, and E increase when Me replaces CH_2Ph, when α- replace β-isomerides, or when pyranosides replace furanosides. E. S. H.

Thermal decomposition of silver oxalate. J. Y. MACDONALD and R. SANDISON (Trans. Faraday Soc., 1938, **34**, 589—594; cf. A., 1936, 940).—The change in electrical conductivity of $Ag_2C_2O_4$ crystals during thermal decomp. lends support to the assumption that the nuclei are solid rather than laminar. The temp. coeff. is const. over the most strongly accelerating period and then rises to a higher val., indicating that the reaction is more complex than has hitherto been supposed. The time required for 50% decomp. is greatly influenced by the environment of the crystals. It varies from <2 min. in PhCHO to 324 min. in paraffin wax. F. L. U.

Oxidation of metals. V. Oxidation of molten lead. L. L. BIRCUMSHAW and G. D. PRESTON (Phil. Mag., 1938, [vii], **25**, 769—782).—The rate of formation of oxide films on molten Pb at 500°, 600°, and 700° is in accordance with the "parabolic" law in the early stages but later conforms to an equation of the type $\log p = kt + c$. *X*-Ray examination shows that the film at the Pb–oxide interface is red, tetragonal PbO, while at the O_2–oxide surface it is yellow orthorhombic PbO, probably present as a thin single-crystal film. T. H. G.

Velocity of dissolution of comminuted solids. VI. Velocity of dissolution of potassium ferricyanide and dichromate. VII. Indirect proof of applicability of the general equation for velocity of dissolution. W. JACEK (Rocz. Chem., 1938, **18**, 18—23, 24—30; cf. A., 1937, I, 468).—VI. The rate of dissolution of $K_3Fe(CN)_6$ in H_2O at 17—19° is 5 times that of $K_2Cr_2O_7$.

VII. The val. of the temp. coeff. of dissolution of $K_2Cr_2O_7$, as calc. from Jacek's equations (A., 1929, 1375), is in good agreement with that reported by Jabłczyński and Gutman (A., 1932, 345). R. T.

Velocity of dissolution of magnesium in aqueous ammonium chloride. II. E. BEKIER and S. GRAŻEWICZ (Rocz. Chem., 1938, **18**, 9—15; cf. A., 1930, 866).—The val. of the velocity coeff. $\propto 1/[NH_4Cl]$, and is independent of the p_H over the range 5—8·6. R. T.

Production of detonation in explosives under the action of a thermal impulse.—See B., 1938, 735.

Inhibition of homogeneous organic decompositions. F. O. RICE and O. L. POLLY (J. Chem. Physics, 1938, **6**, 273—279).—The inhibitory action of EtONO on the O_2-promoted chain decomp. of MeCHO is considerable at 300° and practically negligible at 500°. Addition of NO has also been investigated for the MeCHO decomp. near 500°; small amounts of NO (<0·5%) accelerate the decomp. rate. Inhibition by NO of org. decomps. is accounted for by a free radical mechanism, assuming that NO can both start and stop chains. Inhibition by propylene is also a free radical mechanism. W. R. A.

Catalytic influence of reaction products on the speed of decomposition of chromic acid in solutions of sulphur trioxide in water. H. C. S. SNETHLAGE (Rec. trav. chim., 1938, **57**, 459—466; cf. A., 1936, 1073, 1470).—In 99·8% H_2SO_4, a reaction product retards the rate to an extent which depends on the ratio of CrO_3 to reaction product concn.; at 50% decomp. in this solvent, reaction is pseudo-unimol. Results in solutions of >60% H_2SO_4 are regarded as due to two simultaneous reactions, one pseudo-unimol., preponderating at 100% H_2SO_4 and retarded by a reaction product, and the other bimol., preponderating at 80% H_2SO_4 and accelerated by a reaction product. M. R.

Highly polymerised compounds. CLXXXVIII. Kinetics of chain polymerisation. IV. Acceleration of polymerisation of styrene by benzoyl peroxide. G. V. SCHULZ and E. HUSEMANN (Z. physikal. Chem., 1938, **B**, **39**, 246—274; cf. A., 1937, I, 569).—Measurements in PhMe solution at 27—120° are recorded. Bz_2O_2 accelerates the polymerisation and diminishes the chain length. The Bz_2O_2 first forms an endothermic intermediate with styrene (heat of formation, — 4500 g.-cal.), which is transformed unimolecularly into an active form. The latter is the starting point for the chain polymerisation. Bz_2O_2 has no direct influence on the growth and breaking of chains. Chains are broken by collision of mols. in course of polymerisation. The time of growth of a single chain at 100° in a M solution is 10—100 sec. In the later stages of the polymerisation the reaction becomes pseudo-unimol., and the chain length remains approx. const. This is probably owing to the action of polystyrene in hindering chain breaking. H. J. E.

Amorphous and crystallised oxide hydrates and oxides. XLI. Active and inactive bi- and ter-valent iron in homogeneous and heterogeneous systems. A. KRAUSE [with Z. ALASZEWSKA and Z. JANKOWSKI] (Ber., 1938, **71**, [*B*], 1033—1040).—The oxidation of HCO_2H is induced by $Fe^{\cdot\cdot}$, whereas $Fe^{\cdot\cdot\cdot}$ is inactive; in the system $AcOH–H_2O_2$ both types of ion are without influence if the medium is sufficiently acidic. In a heterogeneous system Fe^{III} when present as $Fe(OH)_3$ is inferior to Fe^{II} since the action is truly catalytic. As redox catalyst, the active OH of which contain reactive H, amorphous $Fe(OH)_3$ causes the oxidation of unlimited amounts of AcOH and HCO_2H by H_2O_2. For the same reasons hydrolysed solutions of Fe^{III} salts show a positive behaviour since their mols. are provided with OH groups (basic salts). Dissolved Fe^{III} is not identical with $Fe^{\cdot\cdot\cdot}$ ions. $Fe^{\cdot\cdot}$ induces the oxidation of H_3PO_3 with H_2O_2. $Fe(OH)_3$ is inactive in this case as a consequence of "blocking" of its active H, adsorption, or complex formation. Therefore H_3PO_3 is a restricting agent and hinders the decomp. of H_2O_2 and the oxidation of HCO_2H by H_2O_2. H_3PO_4 also is markedly restrictive. In heterogeneous systems, Fe^{II}, as Fe_3O_4, has little or no action towards H_2O_2 solution or to the system $HCO_2H–H_2O_2$. H. W.

Catalysis in the exchanges of organic compounds with heavy oxygen water. I. ROBERTS (J. Chem. Physics, 1938, **6**, 294).—The exchange of ^{18}O from $H_2{}^{18}O$ and certain substances in the absence of a catalyst and under conditions of acid and base catalysis has been investigated. MeOH and $PhNO_2$ do not exchange at 25° even with a catalyst. KOAc without a catalyst showed no exchange. AcOH with 0·1N-HCl at 25° exchanges 2 O atoms in 40 days. BzOH at 100° in 4 hr. exchanges 2 O atoms with and without 0·1N-HCl. W. R. A.

Phosphoric acid as catalyst in the ethylation of phenol.—See A., 1938, II, 273.

Velocity coefficients of the reaction of oxidation of hydrogen at a cupric oxide catalyst. I. E. ADADUROV and B. R. MANOILENKO (Ukrain. Chem. J., 1938, **13**, 139—150).—The velocity coeffs. increase with rise in temp. from 250° to 450°, and are at a max. for 1 : 1 CuO–fireclay catalysts. The reaction is of the first order. R. T.

Heterogeneous catalysis. III. Sorption of hydrogen by diamond. E. STORFER (Trans. Faraday Soc., 1938, **34**, 639—640).—Comments on papers by Barrer (A., 1936, 1333) and the author (*ibid.*, 153). F. L. U.

Catalytic exchange of gaseous oxygen isotopes. I. Exchange of oxygen atoms between oxygen and water vapour or carbon dioxide at the surface of platinum sponge and platinum [wire]. N. MORITA and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 357—370; cf. A., 1937, I, 251).—Exchange of O isotopes between O_2 and H_2O vapour occurs in Pt sponge above 550°, and on Pt wire above 760°. With CO_2 and O_2 exchange is rapid at 600° and still observable at 300—500°. From the coincidence of this temp. range with that of the "second" activated adsorption of O_2 on Pt it is inferred that this process plays a decisive part in the exchange. The rate of exchange is nearly independent of the composition of the mixture over a wide range. F. L. U.

Hydrogenation of simple sulphur compounds. I. Nickel subsulphide as a catalyst. R. H. GRIFFITH and S. G. HILL. **II. Reactions of carbon disulphide and sulphur dioxide.** B. CRAWLEY and R. H. GRIFFITH (J.C.S., 1938, 717—720, 720—723).—I. Reduced Ni at 350° with CS_2 in N_2 gives mainly NiS, Ni_3S_2 being prepared by treating NiS with H_2 at 300° or by the action of coal gas on Ni at 250°. Adsorptions of CS_2 and SO_2 on NiS and Ni_3S_2, and of H_2, MeSH, and COS on Ni_3S_2, have been measured and discussed.

II. With Ni_3S_2 as catalyst at 100—250°, the hydrogenation of CS_2 is initially of first order with respect to CS_2, but is retarded by higher $[CS_2]$. With increasing $[CS_2]$, MeSH and H_2S production reaches a max. and then decreases; retardation is thus due to CS_2 itself. MeSH is the primary hydrogenation product. With SO_2, reaction is also of first order, with slight retardation at higher concn. Results are discussed from the point of view of relative adsorptions. M. R.

Influence of catalysts on decomposition of sodium sulphate. S. D. SCHARGORODSKI (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **4**, 459—470).—The % decomp. of Na_2SO_4 at 1200° is increased by metal oxides (0·0005—0·05%) in the order $V_2O_5 > WO_3 > Cr_2O_3 > CeO_2 > Fe_2O_3$. In presence of SiO_2 the order is $Fe_2O_3 > V_2O_5 > WO_3 > CeO_2 > Cr_2O_3$, and the effect is > that calc. by adding the separate effects of SiO_2 and metal oxide. F. L. U.

Optical study of the behaviour of manganese catalyst in strongly acid solutions in presence of ozone. L. N. KASCHTANOV and O. N. OLESCHTSCHUK (J. Gen. Chem. Russ., 1938, **8**, 341—345).—The amount of Mn^{III} formed rises, and of MnO_2 falls, with increasing $[H_2SO_4]$, when O_3 is passed into acid aq. $MnSO_4$. Presence of PhOH favours formation of MnO_2. R. T.

Action of inorganic additions as single and mixed catalysts in the water-gas process. C. KRÖGER and G. MELHORN (Brennstoff-Chem., 1938, **19**, 157—169).—Addition of various metallic oxides accelerated the reaction between graphite and steam at 600—800° in the following order of increasing activity: Al, Co, Mn, Tl, U, Fe, Ni, Cr, Cu. At 700° under the experimental conditions used, graphite + 8% of CuO effected a 22% conversion of steam into gas as compared with 6% conversion with graphite alone. Combinations of two oxides exhibited no greater catalytic activity than the single oxides. Alkali carbonates were highly active as catalysts, addition of K_2CO_3 effecting a 32% decomp. of steam at 660°; the order of increasing activity of the carbonates was: Li, Cs, Rb, Na, K. Mixed catalysts containing alkali carbonates showed a greater activity than corresponded with the simple additive rule, the most effective being K_2CO_3–CuO and K_2CO_3–Co_3O_4; with the latter a 65% conversion was obtained at 650°. The mechanism of the action is discussed. With some catalysts, *e.g.*, ThO_2 and Li_2CO_3, small quantities (0·3—2·1%) of unsaturated hydrocarbons were formed. With the alkali carbonates the water-gas equilibrium was attained in the gas at 570°. The Boudouard equilibrium ($C + CO_2 \rightleftharpoons 2CO$) was approached with NiO, K_2CO_3–Co_3O_4, and K_2CO_3–CuO, but was not reached in any of the experiments. A. B. M.

Catalytic combustion of gases on metals. W. DAVIES (Engineering, 1938, **145**, 587—589).—Comparison is made of the rates of heterogeneous combustion of various gas-air mixtures catalysed by a Pt wire of 0·001 in. diameter, the temp. of the wire being deduced from its resistance and the rate of combustion on its surface inferred by plotting the electrical input against the temp. For equally favourable conditions in the heterogeneous phase, relative rates for CO and H_2 are governed by rates of diffusion to the wire as well as by relative heats of combustion. With increasing temp., combustion rates with CO and H_2 reach max. and then decrease; the catalytic activity of the wire thus diminishes at high temp. A difference in initiation temp. does not necessarily involve preferential action in mixtures; a small amount of C_2H_2 suppresses the combustion of H_2 over a considerable temp. range. Au, Ag, Cu, and Fe wires are ineffective under similar conditions; Ni promotes combustion of C_2H_2. M. R.

Influence of contact poisons on the direction of heterogeneous catalytic reactions. M. S. PLATONOV and V. I. TOMILOV (J. Gen. Chem. Russ., 1938, **8**, 346—356).—HCO_2H undergoes decomp. at a Ni catalyst according to the reactions (*a*) $CO_2 + H_2 \leftarrow HCO_2H \rightarrow CO + H_2O$ (*b*). The velocity of reaction (*a*) rises steadily with rising temp. from 200° to 400°, whilst that of (*b*) is max. at 300°. Presence of H_2O favours (*a*), but depresses (*b*), to an extent ∝ temp. at >250°. H_2S inhibits both reactions, but (*b*) more than (*a*), and to a greater extent at 350° than at 250°. SO_2 interferes with both reactions, as a result of the processes $SO_2 + 3H_2 \rightarrow H_2S + 3H_2O$; $2H_2S + SO_2 \rightarrow 2H_2O + 3S$. H_2SO_4 favours (*b*), but depresses (*a*), As_2O_3 inhibits (*b*) at 250—350°, and (*a*) at <300°, but has little effect at >300°, and As_2O_5 favours (*a*) at 250—350°, and (*b*) at 250—300°, but not at >300°. R. T.

Hydrogenation of ethylene by iron synthetic ammonia catalysts. R. C. HANSFORD and P. H. EMMETT (J. Amer. Chem. Soc., 1938, **60**, 1185—1190).—The reaction rate with pure and promoted Fe catalysts has been determined between −40° and −89° and correlated with adsorption data and surface measurements. The rate of reaction with the promoted catalyst is considerably < with the unpromoted catalyst. The lower-temp. type of activated H_2 adsorption plays the dominant part in the reaction, C_2H_4 being physically adsorbed. E. S. H.

[Catalytic] hydration of propylene.—See B., 1938, 623.

[Catalytic] synthesis of benzine from carbon monoxide and hydrogen.—See B., 1938, 616.

Catalysts for synthesis of esters from alcohols.—See B., 1938, 624.

[Catalytic] hydrogenation of groundnut oil.—See B., 1938, 682.

Rôle of catalysis in textile chemistry.—See B., 1938, 631.

Densities of D_2O and H_2O. Electrolytic separation of oxygen isotopes. L. TRONSTAD and J. BRUN (Trans. Faraday Soc., 1938, **34**, 766—773).—The prep. of 100% D_2O of normal O-isotopic ratio is described. Vals. of d_{20}^{20} have been redetermined as follows: D_2O 1·10726±0·00001, H_2O 0·999980±0·000001. These vals. correspond with a mol. abundance ratio of D_2O in natural water of 1 : 5960±300. The electrolytic separation factor for the O isotopes is $\alpha = 1{\cdot}036$. The amount of ^{18}O in commercial heavy water from Norsk Hydro-Elektrisk Kvaelstof A./S. corresponds with 0·32% $D_2{}^{18}O$. F. L. U.

Electrolysis of solutions of potassium and aluminium chlorides in nitrobenzene. V. A. PLOTNIKOV and O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **4**, 405—412).—Electrolysis of $PhNO_2$ solutions of KCl + $AlCl_3$ with Al anode and Cu cathode separated by a diaphragm leads at first to the deposition of pure K. In experiments of long duration the cathodic deposit contains in addition Al, Cl, and $PhNO_2$, and explodes when heated. F. L. U.

Cathode processes. New method for the study of solutions. O. K. KUDRA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **4**, 385—392).—The relation $C = \alpha\sigma t^{\frac{1}{2}}$, in which t is the time needed for the formation of a black powdery deposit on the cathode (cf. A., 1937, I, 369), C is the cation concn., and σ the c.d., is deduced. The formula is in agreement with the results of experiments with aq. $ZnSO_4$, $AgNO_3$, and $CuCl_2$. The measurement of the time required for blackening of the cathode can be used to calculate the cation concn. F. L. U.

Electrolysis of solutions of protoactinium. (MLLE.) H. EMMANUEL-ZAVIZZIANO and M. HAÏSSINSKY (Compt. rend., 1938, **206**, 1102—1103; cf. A., 1937, I, 253).—Electrolysis of a solution containing Ti and Pa in presence of NH_4F (p_H approx. 6) gives a

deposit on a Pt cathode in which Pa is enriched. Increase in p_H and in c.d. favours the formation of white hydroxide and of basic salts on the cathode. Black, adherent deposits are obtained at p_H 5·8 with vigorous agitation of the solution, and with a c.d. of 10 ma. per sq. cm. H. J. E.

Electrochemical behaviour of rhodium. V. Higher stages of oxidation of rhodium. II. G. GRUBE and H. AUTENRIETH (Z. Elektrochem., 1938, **44**, 296—299; cf. A., 1937, I, 419).—Experiments on the electrolytic oxidation of Rh^{III} compounds have been continued. Complex amino- and cyano-salts cannot be further oxidised. Fluoride and fluosilicate solutions are partly oxidised to Rh^{IV}. Nitrate and especially basic nitrate solutions afford unstable solutions in which the valency of Rh is >4. Perchlorate solutions prepared in the cold and containing $HClO_4$ in excess are oxidised almost completely to Rh^{VI}. The oxidation potential (Rh^{VI}–Rh^{III}) is approx. 1·46 v. in HNO_3 solution and approx. 1·48 v. in $HClO_4$ solution. *Chloropentammino-rhodium*^{III} *perchlorate*, $[Rh(NH_3)_5Cl](ClO_4)_2$, is described. F. J. G.

Electrolysis of fused salts. P. DROSSBACH (Z. Elektrochem., 1938, **44**, 288—291).—The increase of current efficiency resulting from the use of a diaphragm between the anode and cathode spaces is only partly to be accounted for by prevention of the reunion of metal and anode gas; another important factor is that the fused salt in the small cathode space becomes saturated with dissolved metal at an earlier stage in the electrolysis. A regulus of Cd was obtained after some hours in the electrolysis of fused $CdCl_2$, but addition of KCl enabled Cd to be obtained much sooner. In the electrolysis of fused $SnCl_2$, $SnCl_4$ is formed quantitatively at the anode. The factors controlling losses by recombination, and the importance of considering the equilibrium diagram for the system metal–salt, are discussed. (Cf. A., 1938, I, 85, 205). F. J. G.

Electroplating of lead–antimony alloys.—See B., 1938, 669.

Theory of cathodic protection. R. B. MEARS and R. H. BROWN (Trans. Electrochem. Soc., 1938, **74**, Preprint 3, 35—43).—Experiments with Zn–Cu couples immersed in 20% aq. NaCl indicate that, in cases of purely electrochemical corrosion, cathodic protection is completely effective only when the local cathodes on the corroding specimen are polarised to the corresponding open-circuit electrode potential of the local anodes. J. W. C.

Electrochemistry of corrosion. R. H. BROWN and R. B. MEARS (Trans. Electrochem. Soc., 1938, **74**, Preprint 2, 15—33).—A method for measuring the corrosion current of Al immersed in neutral NaCl is described. Comparison between the observed wt. loss determinations and the theoretical loss calc. from the current–time curves indicates that the corrosion of Al is purely electrochemical. Continuous measurements of the single electrode potential of Al can probably be utilised to detect the onset of film breakdown but do not necessarily afford any indication of the intensity of attack. J. W. C.

Electrolysis of salts of heptoic acid alone or mixed with nitrates.—See A., 1938, II, 258.

Electrochemical "nitration." [Ester formation from ethylene.] V. ÖHMAN (Svensk Kem. Tidskr., 1938, **50**, 84—98).—Anodic oxidation of C_2H_4 (I) with HNO_3 or nitrates to give $(CH_2{\cdot}O{\cdot}NO_2)_2$ (II) and $([CH_2]_2{\cdot}O{\cdot}NO_2)_2$ (III) proceeds by way of free NO_3, necessitating a high anodic overvoltage. Current yields of 100% (II) + (III) (2 : 3) are obtained with $Ca(NO_3)_2$ in slightly acid anhyd. $COMe_2$ using high (I) concn., a high c.d., and bright Pt electrodes. Addition of H_2O reduces the yields by lowering the overvoltage, decreasing the stability of NO_3 and the solubility of (I), and favouring the formation of $O([CH_2]_2{\cdot}O{\cdot}NO_2)_2$. $(CH_2)_2O$ and $NO_2{\cdot}[CH_2]_2{\cdot}O{\cdot}NO_2$ have not been detected. M. H. M. A.

Reaction of hydrogen and deuterium with spattered magnesium electrodes. O. MASAKI and Y. MORIMOTO (J. Sci. Hirosima Univ., 1938, **8**, 113—120).—When a discharge is passed between Mg electrodes in a mixture of Ne with H_2 and D_2 (prepared by the action of K on 50% D_2O), the ratios of the intensities of the D_β, D_γ, and D_δ lines to those of the corresponding H lines increase gradually. If Mg is first spattered on the walls of the discharge tube in an atm. of Ne, and, after admission of the H_2 and D_2, a discharge is passed between Al electrodes in the same vessel, similar changes in relative intensity are observed, but they occur more slowly. The results are attributed to the more rapid combination of H_2 with Mg, owing to the greater collision frequency and smaller energy of dissociation of H_2 mols. J. W. S.

"Clean-up" of inert gases in the electric discharge. II, III. H. ALTERTHUM and A. LOMPE (Z. tech. Physik, 1938, **19**, 113—116, 116—118; cf. A., 1937, I, 53).—II. The dependence of the rate of clean-up on the dimensions, material, and crystal structure of the electrodes, and on the cathode voltage drop, has been studied. Curves are given showing the variation of gas pressure, tube voltage, and rate of clean-up of Ne with time, for Th electrodes.

III. The rate of clean-up shows large variations with the nature of the electrode material, no relation being observed with other physical properties of the material, the cathode voltage-drop, or the degassing of the electrodes. The bottom of a hollow electrode plays no special part in the clean-up process. A. J. E. W.

Photo-oxidation of ammonium compounds in solution and soil.—See B., 1938, 644.

Theory of the blackening curve of photographic materials. II. J. E. DE LANGHE (Physica, 1938, **5**, 335—344).—The author's general theory (A., 1937, I, 39) is developed with regard to solarisation. Assuming that the developability of an emulsion grain is either suppressed or seriously reduced if there are more than a certain no. of activated nuclei per grain, statistical calculation gives for the ratio of the no. of developable grains to the average no. of nuclei per grain, a curve with a max. The author's earlier views on deviations from the law of reciprocity can easily be extended to the solarisation region.

Previous work on the no. of sensitive spots is corr. in the light of recent observations on the origin of the latent image. T. H. G.

Theory of colour photography.—See B., 1938, 733.

Photolysis of the system uranyl sulphate–potassium iodide–water. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 564—566).—I is slowly formed by a dark reaction following hydrolysis of UO_2SO_4; on illumination production of I is much more rapid, being slightly accelerated by a small, and slightly inhibited by a large, % of NaCl. Exposure to atm. O_2 gives greatly increased reaction. M. R.

Mercury-photosensitised decomposition of ethane. E. W. R. STEACIE and N. W. F. PHILLIPS (J. Chem. Physics, 1938, **6**, 179—187).—In Hg-photosensitised decomp. of C_2H_6 the products of the reaction, analysed by low-temp. fractional distillation, are exclusively CH_4, C_3H_8, and C_4H_{10}. The H_2 and higher hydrocarbons reported previously arise from the secondary reactions involving decomp. of C_3H_8 and C_4H_{10}. The mechanism put forward is: $C_2H_6 + Hg\ (2^3P_1) = 2CH_3 + Hg\ (1^1S_0)$; $CH_3 + C_2H_6 = CH_4 + C_2H_5$; $2CH_3 = C_2H_6$; $2C_2H_5 = C_4H_{10}$; $CH_3 + C_2H_5 = C_3H_8$. W. R. A.

Photopolymerisation of butadiene. G. GEE (Trans. Faraday Soc., 1938, **34**, 712—728).—The quantum yield in the Hg-sensitised photopolymerisation of butadiene is small (about 0·3) and not greatly affected by change of temp. or pressure in the range 15—100° and 2—70 mm. Reaction occurs both in the gas phase and on the surface. The proportion of the surface reaction increases with lowering of pressure. The kinetics of the reaction give a quant. and semi-quant. account of the gaseous and surface reactions, respectively. The reaction products are an insol. polymeride with smaller amounts of H_2 and a cyclic dimeride. The proportion of the latter is greatest at low pressures. F. L. U.

Photochemical reactions involving hydrogen sulphide and chloromethanes. W. A. AVERY and G. S. FORBES (J. Amer. Chem. Soc., 1938, **60**, 1005—1011).—Photolysis of H_2S solutions in CH_2Cl_2, $CHCl_3$, or CCl_4 by λλ 254 or 208 mμ. yields HCl in each case. The quantum yields based on HCl mols. formed per quantum absorbed by H_2S are in the order $CCl_4 > CHCl_3 > CH_2Cl_2$. The reaction products in CCl_4 also contain S, C_2Cl_6, and $CCl_3{\cdot}SH$. The reaction mechanisms involved are discussed. E. S. H.

Photolysis of aliphatic aldehydes. VI. Acetaldehyde. F. E. BLACET and D. VOLMAN (J. Amer. Chem. Soc., 1938, **60**, 1243—1247; cf. A., 1937, I, 627).—The volatile products of photolysis of MeCHO are CH_4, H_2, and CO. The ratio H_2 : CO decreases with increase of pressure, increases with increase in intensity or decrease in λ, and passes through a max. about 30°. A tentative chain mechanism of photolysis is proposed. The correlation between the volatile and the resinous products is discussed. E. S. H.

Chemical reactions of organic compounds with *X*-ray-activated water. H. FRICKE, E. J. HART, and H. P. SMITH (J. Chem. Physics, 1938, **6**, 229—240).—Gas-free solutions of CO, alcohols, aldehydes, ketones, and acids of the aliphatic series were irradiated at different concns. and p_H, and the reactions studied by gas analysis and potentiometric acid analysis. Foreign org. matter was excluded by methods described. Oxidation and condensation reactions with evolution of H_2 frequently occur. CO_2 was liberated from certain acids; no CO, O_2, or hydrocarbons were evolved. The p_H affects both the rate and the nature of the reaction. The influences of concn. of substance and *X*-ray intensity are discussed. Reactions in systems containing two components are briefly described; reactions in the presence of O_2 have also been investigated. The reactions in *X*-ray-activated H_2O are similar to, but more complicated than, reactions produced by H_2O activated with light inside the absorption band at 1900 A. W. R. A.

Photographic action of artificial radio-elements. C. GROVEN, J. GOVAERTS, and G. GUÉBEN (Nature, 1938, **141**, 916—917).—A sheet of Ir activated by exposure to neutrons slowed down in paraffin blackened a photographic plate when placed upon it. When Al is placed between the activated Ir and the plate the intensity of blackening ∝ the thickness of the Al. Radio-P has a similar effect on a photographic plate. L. S. T.

Effect of electric fields on the decomposition of ammonia by α-rays. (MISS) C. SMITH and H. ESSEX (J. Chem. Physics, 1938, **6**, 188—196).—The ion yields in the α-ray decomp. of gaseous NH_3 at 30° and 100° in the absence and presence of electric fields are recorded. The ion yields consist of two parts, one due to ion recombination, the other independent of ion recombination. The mechanisms of these two contributions and the extents to which they occur at the different temp. are discussed. W. R. A.

Effect of deuterium substitution in colour.—See A., 1938, II, 254.

Oxidation of [copper–]beryllium bronzes. H. N. TEREM (Bull. Soc. chim., 1938, [v], **5**, 589—600).—A detailed account of results reported previously (B., 1937, 794, 1220). J. W. S.

Magnetic study of the dehydration of crystalline cupric hydroxide. (MLLE.) L. CHAUMETON (Compt. rend., 1938, **206**, 1104—1106).—Measurements of the change in χ in dehydrating pptd. $Cu(OH)_2$ at 110° and at 150—160° are recorded. There is no evidence for the formation of the intermediate $3CuO,Cu(OH)_2$. H. J. E.

Zinc peroxide. G. COGNÉ (Compt. rend., 1938, **206**, 1119—1120).—The *compound* $ZnO_2,0{\cdot}5H_2O$ has been prepared by the action of 110—190-vol. H_2O_2 on $Zn(OH)_2$, or by the action of conc. H_2O_2 on a solution of a Zn salt in excess of aq. NH_3. The peroxide is washed at 0° with H_2O_2, $COMe_2$, and EtOH, and dried in vac. over P_2O_5. It is decomposed by H_2O, forming H_2O_2. The peroxide group in the mol. is constitutional, and is not present as an additive compound of H_2O_2. H. J. E.

Zinc sulphate hydrates. P. VALLET and M. BASSIÈRE (Bull. Soc. chim., 1938, [v], **5**, 546—556).—Wt. decreases in samples of $ZnSO_4,7H_2O$ for regularly

increasing temp. indicate that hexa-, tetra- and monohydrates are intermediate stages between heptahydrate and anhyd. salt. The necessary crit. conditions for isolation are discussed and the existence of the tetrahydrate is confirmed by *X*-ray analysis of the series. M. R.

Hydrolysis of cadmium benzenesulphonate solutions. (MLLE.) M. QUINTIN (Compt. rend., 1938, **206**, 1215—1217).—The variation of the p_H with concn. (*C*) for 0·001—0·082M-$(PhSO_3)_2Cd$ has been investigated; the results are considered in relation to vals. of E_{Cd} obtained over the same concn. range (A., 1938, I, 254). For $C > 0{\cdot}01$M, $[Cd^{\cdot\cdot}] = K[H^{\cdot}]^3$, corresponding with formation of dissolved $Cd(OH)_2$ on hydrolysis; in more dil. solutions, $[Cd^{\cdot\cdot}] = K'[H^{\cdot}]^2$, indicating pptn. of the $Cd(OH)_2$. A. J. E. W.

Mixed precipitation of barium and strontium sulphates. B. GOLDSCHMIDT (Compt. rend., 1938, **206**, 1110—1113).—In the pptn. of sulphates by adding 0·2N-$(NH_4)_2SO_4$ to aq. $SrCl_2$ containing 0·1% of $BaCl_2$, the unstable hydrated $SrSO_4$ does not entrain $BaSO_4$. Only when it is transformed into the anhyd. form are mixed crystals obtained. With larger $[BaCl_2]$ formation of the hydrate of $SrSO_4$ is suppressed. The enrichment of Ba in the pptd. mixed sulphate is diminished by rise in temp. H. J. E.

Gallium. III. Preparation and resolution of complex oxalato-compounds of gallium into optical isomerides. P. NEOGI and N. K. DUTT (J. Indian Chem. Soc., 1938, **15**, 83—86).—From solutions of $Ga(OH)_3$ in alkali H oxalate solutions the following *complex oxalates* may be crystallised: $M_3[Ga(C_2O_4)_3],3H_2O$ (M = NH_4, K, Na). Double decomp. affords l-*strychnine gallium trioxalate*, *l*-$[Ga(C_2O_4)_3](HC_{21}H_{22}O_2N_2)_3,12H_2O$, $[\alpha]_D^{32}$ −15·5°. Fractional extraction with H_2O leaves as residue the l-*strychnine* d-*Ga* salt, $[\alpha]_D^{32}$ +29°, and from this the *K* and *NH*$_4$ d-*salts* may be obtained by double decomp. They have $[\alpha]_D^{32}$ +16·5° and +15·5°, respectively (α-vals. refer to 1% solution in 50% EtOH). F. J. G.

(A) Preparation and analysis of a double thallium salt. (B) Preparation of univalent thallium hydroxide. P. V. GOGORISCHVILI and V. N. KULGINA (J. Gen. Chem. Russ., 1938, **8**, 302—304, 305—307).—(A) H_2O_2 is added to aq. $TlNO_3$ or Tl_2SO_4, and Cl_2 is passed at 25°; Tl is pptd. quantitatively as $TlCl_3,3TlCl$. Tl^I is best determined by pptn. with KI, washing the ppt. with 96% EtOH.

(B) Tl_2O_3 and H_2O_2 yield TlOH by the reaction $Tl_2O_3 + 2H_2O_2 \rightarrow 2TlOH + H_2O + 2O_2$. R. T.

Concentration of ^{15}N and ^{34}S. H. G. THODE, J. E. GORHAM, and H. C. UREY (J. Chem. Physics, 1938, **6**, 296).—A 46-fold increase in the isotope ratio of ^{15}N and ^{14}N was brought about in approx. two weeks by the exchange reaction between NH_4NO_3 solution and NH_3 using a cascade apparatus described, and a sample of 14·8% $^{15}N_2$ was obtained. Using the exchange reaction between $NaHSO_4$ solution and SO_2 in a similar apparatus led to a 3-fold rise within 7 days in the $[^{34}S]$ and a 6·8% sample of ^{34}S was procured. W. R. A.

Phosphoric acids.—See B., 1938, 643.

Oxygen exchange reaction of glycine hydrochloride and water. W. H. MEARS (J. Chem. Physics, 1938, **6**, 295).—$NH_2{\cdot}CH_2{\cdot}CO_2H,HCl$ exchanges its O with $H_2{}^{18}O$ completely at 100° within 24 hr. at p_H 1·9. Under identical conditions $NH_2{\cdot}CH_2{\cdot}CO_2H$ does not exchange. W. R. A.

Carbamide as an oxidising agent in presence of nitrous acid. E. JUSTIN-MUELLER (Bull. Soc. chim., 1938, [v], **5**, 262—263).—Nascent O is formed when $CO(NH_2)_2$ and HNO_2 react in presence of HCl. The oxidising reaction explains the formation of a red ppt. when HCl is added to nitroso-β-naphthol in presence of $CO(NH_2)_2$. E. S. H.

[Generation of] hydrogen sulphide. V. T. JACKSON and F. C. SUHRER (J. Chem. Educ., 1938, **15**, 179).—Equal amounts of S and rosin (20-mesh) are heated. 2 g. of the mixture give sufficient H_2S for most pptns. The C residue is easily removed. L. S. T.

Action of magnesium on chromium trioxide. E. MONTIGNIE (Bull. Soc. chim., 1938, [v], **5**, 567—568).—In addition to MgO and Cr, binary compounds of Mg and Cr are formed when excess of Mg is used. Treatment of products with dil. acid suggests the compositions Cr_2Mg_2, Cr_2Mg_3, Cr_2Mg_6, Cr_2Mg_8. M. R.

Uranyl orthophosphates. A. CHRÉTIEN and J. KRAFT (Bull. Soc. chim., 1938, [v], **5**, 372—385).—Conductivity measurements and chemical analysis show that the addition of $UO_2(OAc)_2$ to H_3PO_4 in aq. solution yields UO_2HPO_4 (crystals of relatively high solubility) followed by $(UO_2)_3(PO_4)_2$, as a gelatinous ppt. of low solubility, the latter being formed directly by adding H_3PO_4 to $UO_2(OAc)_2$. Both phosphates are hydrated and sol. in H_3PO_4 with formation of unstable complexes, the mono-acid salt being pptd. on dilution. Addition of $UO_2(OAc)_2$ to sol. mono-, di-, and tri-phosphates of K, Na, NH_4, or Ca gives hydrated ppts. of low solubility of type UO_2MPO_4 (M univalent). M. R.

Precipitation of perfectly white ferrous hydroxide in presence of potassium nitrate. O. BAUDISCH (Ber., 1938, **71**, [*B*], 992—995).—An apparatus is figured and described by which $Fe(HCO_3)_2$ solution, obtained from Fe powder and CO_2, is pptd. by guanidine carbonate in presence of KNO_3, free from KNO_2. The experiment is suitable for lecture purposes. H. W.

Action of nitric acid on iron and on iron carbide. A. TRAVERS and R. DIÉBOLD (Bull. Soc. chim., 1938, [v], **5**, 690—693).—In absence of O_2 the action of dil. HNO_3 (*d* 1·2) on Fe at <30° yields only $Fe(NO_3)_2$. Probably FeO and HNO_2 are formed initially, the former dissolving in the HNO_3 and the latter decomp. to form NO, HNO_3, and H_2O. As dissolution occurs in HNO_3 previously treated with $CO(NH_2)_2$, N oxides are not necessary to start the reaction. In contact with air $Fe^{\cdot\cdot\cdot}$ is formed. In a closed vessel the reaction ceases when all the O_2 has been removed, owing to the equilibrium $2NO + HNO_3 + H_2O \rightleftharpoons 3HNO_2$. In dil. (<10%) HNO_3, the electrode potential (*V*) of Fe with respect to the

H electrode is −0·35 to −0·4 v., and is stable, but in 32·4% HNO_3 *V* is no longer stable and undergoes oscillations about +0·05 v., which occur simultaneously with the alternate formation and dispersion of a brown layer, probably of $NO,Fe(NO_3)_2$, on the metal. With 36·6% HNO_3 oscillation occurs between +0·28 and +0·32 v.; the amplitude increases and frequency decreases with increasing $[HNO_3]$, until with 65·8% acid *V* becomes stable again at +1·32 v., and the metal remains bright. *V* decreases with increasing temp. The action of HNO_3 on Fe_3C is slow in the cold and is accompanied by the production of a brown colour, probably due to NO_2-derivatives of the olefines formed. These could not be detected by extraction with org. solvents, probably owing to their solubility in H_2O. J. W. S.

Action of iron filings and of iron carbide on iodine and water. A. TRAVERS and R. DIÉBOLD (Bull. Soc. chim., 1938, [v], **5**, 693—694).—Action of excess of I and H_2O on Fe filings yields sol. FeI_6 and a ppt. of $Fe(IO_3)_2$. This provides direct proof of the existence of an equilibrium $I_2 + H_2O \rightleftharpoons HI + HOI$. When Fe_3C is agitated with excess of I in cold H_2O the attack is similar to that on pure Fe, and active C is pptd., but the action is too slow for use in the analysis of steel. Action of $CuCl_2,2KCl$ at 70° also causes liberation of C, but the action is rapid and complete. The results indicate that Fe_3C is unstable at low temp. (cf. A., 1936, 1332). J. W. S.

Preparation and analysis of solutions of a tervalent osmium bromide. W. R. CROWELL, R. K. BRINTON, and R. F. EVENSON (J. Amer. Chem. Soc., 1938, **60**, 1105—1107).—Solutions of K_3OsBr_6, free from Os^{IV}, can be obtained by electro-reduction of K_2OsBr_6 in aq. HBr, using a Pt cathode. Methods of analysis of the solutions are described. E. S. H.

***cis*-Tetrammine of quadrivalent platinum.** I. I. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 581—582).—When Cleve's triammine, $[Pt(NH_3)_3Cl_3]Cl,H_2O$, is treated with a large excess of NH_3 the cis-*dichlorotetramminochloride*, $[Pt(NH_3)_4Cl_2]Cl_2$, is obtained. It differs from the *trans*-compound (Gro's chloride) in being much more sol. (7·15% at 20° and 7·75% at 30°) and in its reactions. It is reduced only with difficulty (Zn and HCl) and then affords $[Pt(NH_3)_3Cl]Cl$ (thus confirming the *cis*-configuration), whilst with alkalis a *base*, for which three formulæ are possible, viz., $[Pt(NH_3)_3(NH_2)Cl_2]OH,H_2O$, $[Pt(NH_3)_2(NH_2)_2Cl_2],2H_2O$, or $[Pt(NH_3)_4Cl_2](OH)_2$, is pptd. The cis-*dichlorotetrammino-sulphate* and *-nitrate* have also been obtained. F. J. G.

Cleve's triammine. I. I. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 579—580).—The triammine, $[Pt(NH_3)_3Cl_3]Cl,H_2O$, is best prepared by treating Peyrone's salt, *cis*-$[Pt(NH_3)_2Cl_2]$, with 1 mol. of NH_3, oxidising with Cl_2, and pptg. with HCl. Its solubility at 20° is 5·64%. With KOH it affords the *amidotrichlorodiammine* $[Pt(NH_3)_2(NH_2)Cl_3]$, and with $NaNO_2$ a *nitrodichlorotriammine*, $[Pt(NH_3)_3(NO_2)Cl_2]Cl,H_2O$, which is an isomeride of the known compound and reacts differently with alkalis, affording an *amidonitrodichlorodiammine*, $[Pt(NH_3)_2(NH_2)(NO_2)Cl_2]$. The configurations of these compounds are discussed. The *trichlorotriammino-sulphate* and *-nitrate*, and the *tribromotriammino-bromide*, $[Pt(NH_3)_3Br_3]Br,H_2O$, have also been obtained. F. J. G.

***X*-Ray spectrum analysis of elements.** I. B. BOROVSKI (Zavod. Lab., 1938, **7**, 184—189).—Known methods are discussed. R. T.

Organic precipitants in quantitative analysis. W. PRODINGER (Chem.-Ztg., 1938, **62**, 373—376).—A review.

Coulometric analysis as a precision method. I—III. L. SZEBELLÉDY and Z. SOMOGYI (Z. anal. Chem., 1938, **112**, 313—323, 323—331, 332—336).—I. A technique of electrolytic analysis is developed which permits accurate standardisation of solutions in cases where the material to be determined shows a definite colour change when completely decomposed, or it reacts with another material to give a product which shows such a change. The quantity of current required to produce this change is measured with a Ag coulometer.

II. HCl is determined by electrolysis, using a Ag anode and a rotating Pt cathode, which acts as a stirrer. Excess of KCl is added to the solution. The end-point is determined with an acid–base indicator, preferably changing at $p_H < 7$, *e.g.*, bromocresol-green, added shortly before the end-point is reached. Comparison is made with the colour in a blank specimen containing the same amount of KCl and indicator, to which weighed amounts of the test solution are added to yield the intermediate colour. Electrolysis may also be carried out with a Pt anode if PhOH and KBr are added to react with the Cl_2 formed and prevent reproduction of HCl and HOCl.

III. For standardisation of H_2SO_4, a weighed quantity is added to H_2O containing K_2SO_4 and KCl, and electrolysis is carried out between Pt and Ag electrodes in the same way as for HCl. J. W. S.

Quinhydrone electrode. Application in determining the hydrogen-ion concentration of liquids and semiplastic solids. G. P. SANDERS (Ind. Eng. Chem. [Anal.], 1938, **10**, 274—275).—Modifications of the electrode, sample vessel, and calomel half-cell are described. A Au-plated Pt wire is substituted for the usual glass-sleeve electrode, and a sealed-in Pt wire for a stopcock in the calomel half-cell. Applications of the new electrode and portable half-cell to the determination of p_H of liquids and semi-plastic materials is described. L. S. T.

Use of adsorption indicator in acidimetry and alkalimetry. S. N. ROY (J. Indian Chem. Soc., 1938, **15**, 165).—Fluorescein (or eosin) + $Bi^{...}$ can be used as an indicator in the titration of NaOH or Na_2CO_3 with HNO_3. E. S. H.

Determination of equivalent acidity and basicity of fertilisers. Mixed indicators.—See B., 1938, 703.

Continuous determination of small amounts of water. K. FISCHBECK and E. ECKERT (Z. anal. Chem., 1938, **112**, 305—313).—The H_2O formed by a reaction is swept by a current of H_2 over heated

anhyd. $AlCl_3$. The HCl produced is absorbed in Na_2CO_3, the change in titre of which is determined. When PhOH, BzOH, $COPh_2$, and sucrose are heated and the vapours produced are passed over heated $AlCl_3$, the amounts of HCl produced correspond with $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{3}$, and $\frac{2}{3}$ of the theoretical amounts, respectively. These results are attributed to the formation of org. Al compounds and variation in the temp. of reaction of $AlCl_3$ with org. compounds. Apparatus for the determination is described in detail. J. W. S.

Water analysis.—See B., 1938, 737.

Determination of chlorine in water.—See B., 1938, 737.

Determination of free iodine in iodine ointment.—See B., 1938, 728.

Determination of oxygen in water in presence of nitrites.—See B., 1938, 737.

Reaction of sulphur. L. VAN ITALLIE (J. Pharm. Chim., 1938, [viii], **27**, 465—467).—S with NaOH and C_5H_5N or $COMe_2$ gives a blue colour, passing to green. Similarly $(NH_4)_2S$ with C_5H_5N gives a green colour, and with $COMe_2$ a yellow-green. J. D. R.

Determination of sulphur in steels and iron alloys by combustion in oxygen.—See B., 1938, 662.

Determination of reducing acids of sulphur. E. CHERBULIEZ and A. HERZENSTEIN (Arch. Sci. phys. nat., 1938, [v], **20**, Suppl., 23—25; cf. A., 1935, 184). —$H_2S_2O_3$ and H_2SO_3 in mineral waters may be determined by titration with I in a solution buffered to p_H 7 after elimination of H_2S and $H_2S_2O_4$ by the addition of neutral IO_3' and I'. M. R.

Bromo-iodometric determination of ammonia and its application to the determination of nitrogen after destruction by Kjeldahl's [method]. T. A. G. HAANAPPEL (Pharm. Weekblad, 1938, **75**, 570—574).—NH_3 is oxidised quantitatively to N_2 by 0·1N-NaOBr (prepared from 0·2N-$KBrO_3$, 4N-HBr, and 4N-NaOH) in presence of a buffer containing 4 g. of borax and 3 g. of H_3BO_3 per 100 c.c. (4 c.c. to 5 c.c. of 0·1N-NaOBr). After 15 min. KI and HCl are added and excess of Br is titrated with 0·1N-$Na_2S_2O_3$. The conc. H_2SO_4 solution from the Kjeldahl determination can be neutralised with NaOH and used directly provided no Hg or Cu has been used as catalyst. H_2O_2 is recommended for decolorising the solution. S. C.

Use of Kjeldahl method in examination of nitrogen fixation of germinating leguminous seeds.—See A., 1938, III, 627.

Method of adding alkali in Kjeldahl distillation. L. A. YNALVEZ (Philippine Agric., 1938, **26**, 823—826).—Alkali is added slowly from a funnel via an adjustable screw-clipped tube to the steam inlet tube of the distillation flask, air having been previously swept out of the apparatus by steaming for 5 min. Large excess of alkali is thus avoided, frothing is minimised, and accuracy improved. A. G. P.

Determination of phosphate [in waters and soil extracts] by photo-electric colorimetry. W. J. DYER and C. L. WRENSHALL (Canad. J. Res., 1938, **16**, B, 97—108).—Photo-electric colorimeter technique has been applied to the ceruleomolybdate reaction. The procedure, which serves to differentiate PO_4 from other forms of combined P, can be carried out in presence of extraneous colour or soil org. matter. E. S. H.

Colorimetric determination of phosphate in turbid water and in water containing silicic acid.—See B., 1938, 737.

Iodometric determination of arsenates and arsenites in presence of chlorates. A. B. DRANOVSKI (Zavod. Lab., 1938, **7**, 108—109).—1 g. of $NaHCO_3$ is added to the neutral solution containing As^{III}, As^{V}, and ClO_3', and As^{III} is titrated with 0·1N-I in KI. 2 g. of KI and 10 ml. of conc. HCl are added, and I liberated by ClO_3' is titrated. 50 ml. of conc. HCl are added, and the solution is titrated with 0·1N-$Na_2S_2O_3$ (total As). R. T.

Determination of free arsenic trioxide in calcium arsenite [insecticides].—See B., 1938, 709.

Determination of boron by a modified flame test. H. C. WEBER and R. D. JACOBSON (Ind. Eng. Chem. [Anal.], 1938, **10**, 273).—With the apparatus described the intensity of colour, due to Me_3BO_3, in the flame diminishes quickly when the B content of the sample reaches 0·03 mg., but the total time of duration of colour is practically a linear function of the B content up to approx. 0·1 mg. Glasses etc. are first fused with K_2CO_3, extracted with H_2O, and an aliquot portion is evaporated almost to dryness before applying the method. Even with glasses containing <1% B_2O_3 an accuracy of 10% can be obtained. L. S. T.

Colorimetric determination of silica in a lime mortar.—See B., 1938, 655.

Turbidimetric determination of carbon dioxide in condensed water.—See B., 1938, 710.

Alkalimetric determination of the metallic components of alkali metal salts and of organic compounds and mixtures containing alkali, halogen, sulphur, and arsenic. E. SCHULEK and L. SZLATINAY (Z. anal. Chem., 1938, **112**, 336—342). —The materials containing alkali metal are heated with H_3BO_3 to eliminate other acids, and the borates formed are dissolved and titrated with HCl. Halide salts are preferably moistened with HNO_3 before heating, to minimise loss by evaporation, whilst in presence of AsO_3''' and SO_4'' the salt is mixed with H_3BO_3 and glucose to cause reduction to As''' and S'', respectively. J. W. S.

Application of the Berens–Lassen reaction to the rapid determination of potassium. V. M. TICHOMIROV and S. N. CHOLMOGOROV (Zavod. Lab., 1938, **7**, 33—36).—K is determined as $K_2CuPb(NO_2)_6$, which is pptd. and washed at 7—10°, and weighed; the results differ by 0·2—0·4% from those given by the perchlorate method. The method is not applicable to chlorides containing <5% of KCl, owing to pptn. of $PbCl_2$ from the solutions. R. T.

Determination of potassium in fertilisers.—See B., 1938, 704.

Colorimetric determination of cæsium. E. S. BURKSER and R. V. FELDMAN (Zavod. Lab., 1938, **7**, 166—168).—0·1 ml. of solution, containing 0·13—0·8 mg. Cs, is added to 2 ml. of HCl, followed by 0·2 ml. of a Na silicomolybdate reagent, and the mixture is centrifuged after 2 min. 1 ml. of 5% $SnCl_2$ is added to the washed residue suspended in 30 ml. of H_2O with 2 ml. of HCl, and the blue colour developing is compared with that given by a standard solution. Pb interferes, but not Al, K, Na, Li, Fe, Mg, or SO_4''. R. T.

Separation of calcium as sulphate by precipitation in concentrated methyl alcohol solution. Application to the analysis of magnesite and technical magnesium oxide. E. R. CALEY and P. J. ELVING (Ind. Eng. Chem. [Anal.], 1938, **10**, 264—269).—The Ca is pptd. from Cl', NO_3', or ClO_4' solution that is free from $NH_4^{\cdot}$, $Ba^{\cdot\cdot}$, $Sr^{\cdot\cdot}$, and $Pb^{\cdot\cdot}$, but may contain, in addition to $Ca^{\cdot\cdot}$ and $Mg^{\cdot\cdot}$, small amounts of Al, Fe, and Mn, and very small amounts of the alkalis, by the addition of 99% MeOH in presence of H_2SO_4 until the solution contains 90 vol.-% of MeOH. The order of addition of reagents does not affect completeness of pptn. but influences filtering and washing. The pptd. Ca is weighed as $CaSO_4$ after ignition at 400—450°. The time required for complete pptn. increases with [Mg]. The amount of Ca must be <200 mg., and the ratio of Mg to Ca must be >200 to 1. When the amount of Al or Fe is high pptn. is incomplete. The Fe can be removed by evaporation almost to dryness with $HClO_4$ when the $Fe(ClO_4)_3$ is decomposed into oxide; the $Ca(ClO_4)_2$ can then be extracted from the residue. The $CaSO_4$ method can be applied to magnesite and dolomite, but less satisfactorily to limestone. The sample should contain >3% of Fe, >0·5% of Na + K, and <0·5% of Ca. MeOH is preferable to EtOH, AcOH, or $COMe_2$ for pptg. $CaSO_4$. Data showing the effect of various factors are recorded. L. S. T.

Thermal behaviour of some compounds important in analytical practice. I. Behaviour of $BaCrO_4$ and $MgNH_4PO_4$. B. SAGORTSCHEV (Z. physikal. Chem., 1938, **182**, 31—41).—It has been shown by Hahn's emanation method that all irregularities in the emanation power–temp. curves of $BaCrO_4$ are attributable to impurity, and that pure $BaCrO_4$ is not decomposed after gradual heating to 1000°. Hence in gravimetric determination of $Ba^{\cdot\cdot}$ as $BaCrO_4$ the ppt. can be dried at high temp. No mol. change could be detected at <1000°. Emanation power–temp. curves indicate that $MgNH_4PO_4,6H_2O$ when heated passes successively into $MgNH_4PO_4$, $MgHPO_4$, and $Mg_2P_2O_7$. J. W. S.

Method for determining the radium content of rocks by direct α-ray counting. J. H. J. POOLE (Sci. Proc. Roy. Dublin Soc., 1938, **21**, 595—608).—The rock is de-emanated by one of the usual methods and the Rn removed to an ionisation chamber, the inner electrode of which is connected to a Wynn-Williams type amplifier. The α-ray emission is measured by means of a recording oscillograph or a thyratron counter and compared with that produced by a standard quantity of Rn in the chamber. Full details of this apparatus, of a new fusion furnace, and of the method of working are given. T. H. G.

Introduction of the Schlagdenhauffen (magnesium hypoiodite) reaction for the detection of magnesium into the usual analytical procedure. P. REMY-GENNETÉ (Bull. Soc. chim., 1938, [v], **5**, 666—675).—After removal of heavy metals, NH_3 is eliminated with CH_2O or by boiling almost to dryness with repeated quantities of saturated aq. $Ca(OH)_2$ until the solution remains alkaline. After cooling, a few drops of freshly prepared hypoiodite reagent [0·1N-I in a min. of KI and treated with $Ca(OH)_2$ until almost decolorised] are added, the appearance of a brownish-maroon ppt. indicating the presence of Mg. The theory of the reaction is discussed. J. W. S.

Adsorption of diazo-compounds on cadmium and magnesium hydroxides. IV. Nitrodiazoamino-compounds for the detection of magnesium. F. P. DWYER (J. Proc. Austral. Chem. Inst., 1938, **5**, 149—154).—4-Nitrobenzene-4′-nitro-(1 : 1′)-diazoaminonaphthalene gives a brilliantly coloured lake with $Mg(OH)_2$ which can be used to detect 0·1 μg. of Mg per c.c. P. G. M.

Quantitative spectrochemical analysis. Chemical and metallurgical applications.—See B., 1938, 665.

Quantitative spectrographic analysis of magnesium alloys for manganese and silicon.—See B., 1938, 668.

Determination of magnesia in fertilisers.—See B., 1938, 704.

Volumetric determination of cadmium in presence of other cations. M. E. ZIMBLER (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **4**, 471—479).—Small amounts of Cd in presence of Zn, Cu, Ni, Mg, and Al can be determined to within 0·3% by removing Al with aq. NH_3, and pptg. $CdCO_3$ with Na_2CO_3 or $NaHCO_3$ in presence of warm NH_4Cl. The ppt. is washed, and dissolved in a measured excess of standard acid. F. L. U.

Colorimetric determination of lead in maple syrup.—See B., 1938, 712.

Determination of copper in biological material.—See A., 1938, III, 633.

Determination of small amounts of mercury. N. S. KRUPENIO (Zavod. Lab., 1938, **7**, 161—162).—10 ml. of solution are boiled under reflux for 2 hr. with 20 ml. of aqua regia, Hg^{II} is pptd. by adding excess of $NH_4[Cr(CNS)_4(NH_3)_2]$, the washed ppt. is dried and ignited, and the Hg content of the solution is derived from the wt. of the residual Cr_2O_3. R. T.

Methylene-blue as a reagent for cerium. R. A. REED (Analyst, 1938, **63**, 338—339; cf. A., 1936, 43).—The solution to be tested is oxidised with H_2O_2 in acid solution, methylene-blue is added, and the solution made distinctly alkaline with NaOH. A green colour in place of the usual blue indicates the presence of Ce, 1 p.p.m. of which may be detected in

presence of a large no. of metals, only Hg, Pb, Bi, and MoO_4 interfering. E. C. S.

Application of fluorescence to quantitative analysis. A. Okac (Coll. Czech. Chem. Comm., 1938, **10**, 177—181).—Al may be determined by the fluorescence of the Al salt of morin under standard conditions of solvent and concn. Alkali fluorides may be titrated in presence of NaCl with an alcoholic $AlCl_3$ solution containing morin, the end-point being characterised by fluorescence occurring when Al''' ceases to be removed as the non-fluorescent AlF_6'''. M. R.

Semi-quantitative drop reactions by limitation of the reaction surface. H. Yagoda (Mikrochem., 1938, **24**, 117—130; cf. A., 1937, I, 199).—Details are given of a technique in which drop reactions are carried out in filter-paper in an area of definite cross-section enclosed in a paraffin ring. The paper is impregnated with reagent and the test drop eventually drawn through the confined area. The coloured spot is compared in transmitted light with suitable standards. The procedure is suitable for 0·1—250 μg., and an accuracy of 5 to 10% can be expected. The tests used are the alizarin reaction for Al, the Gutzeit test for As, the cinchonine test for Bi, the benziminazole test for Co, the benzoinoxime, Zn xanthate, or $(NEt_2{\cdot}CS_2)_2Zn$ tests for Cu, the Prussian-blue test for Fe, and the K_2CrO_4 or rhodanine test for Ag. Alcoholic solutions, preferably of MeOH, of the reagents are the most suitable for this method. L. S. T.

Formaldoxime as a colour reagent for metals. Determination of manganese in water and iron. G. H. Wagenaar (Pharm. Weekblad, 1938, **75**, 641—648).—Definite colour reactions are obtained with formaldoxime and the following, the limiting concn. in mg. per l. being given in parentheses: Cu (0·3), Co (1), Ni (0·3), Mn (0·08), Fe''' (0·5), Fe'' (1). In the determination of Mn in H_2O, 10 c.c. are boiled for 5 min. with 2 drops of 4N-HCl and 1 drop of 30% H_2O_2. 1 g. of NaOAc [or ZnO or $(CH_2)_6N_4$] and a drop of $FeCl_3$ solution are added, the solution is filtered, and the ppt. washed with acetate solution. Mn is determined colorimetrically in the filtrate (standard, 10 mg. per l.). A similar method is used for the determination of Mn in Fe after the latter has been dissolved in dil. H_2SO_4 and HNO_3 and the Fe pptd. as basic acetate. Similar methods can be used for the determination of Ni and to a limited extent of Co and Cu, but not Fe. Using $MnSO_4$ and NH_2OH,HCl, CH_2O can be detected colorimetrically at a dilution of >1 : 1000. S. C.

Determination of ferric salts by reduction with cuprous oxide. P. Fleury and M. Harlay (J. Pharm. Chim., 1938, [viii], **27**, 513—522).—Fe^{III} salts are accurately determined by reducing in dil. H_3PO_4 with excess of Cu_2O (complete reduction in 2 min.), filtering, and titrating with $KMnO_4$. A H_2SO_4 medium gives high results, but small quantities of H_2SO_4 or HCl do not affect the reaction, the HCl being pptd. as CuCl. A. Li.

Volumetric determination of iron in aluminium ores.—See B., 1938, 665.

Colorimetric micro-determination of iron.—See A., 1938, III, 633.

Spectroscopic analysis of steels.—See B., 1938, 662.

Precipitation of crystalline nickel and cobalt sulphides in presence of pyridine. E. A. Ostroumov (Zavod. Lab., 1938, **7**, 20—23).—30 ml. of neutral 20% aq. C_5H_5N are added to 75 ml. of a hot Co or Ni salt solution, which is then saturated with H_2S; the sulphides are pptd. in a coarsely cryst., readily filterable form. R. T.

Determination of chromium in aluminium alloy.—See B., 1938, 668.

Analysis of chromite.—See B., 1938, 645.

Effect of phosphate on the determination of tungsten. S. G. Simpson, W. C. Schumb, and M. A. Sieminski (Ind. Eng. Chem. [Anal.], 1938, **10**, 243—245).—The acid pptn. method (HCl + HNO_3 or $HClO_4$ alone) is untrustworthy in presence of even small amounts (0·4 mg.) of P_2O_5. Low results are obtained, and the error increases with increasing amounts of P_2O_5. It is attributed to the formation of paratungstate. In absence of PO_4''', the use of $HClO_4$ is preferable to that of HCl + HNO_3 as the ppt. does not adhere to glass and is more easily filtered. In the cinchonine method, increasing amounts of P_2O_5 up to approx. 20 mg. per 100 mg. of WO_3 give increasingly higher results owing to pptn. of WO_3 + cinchonine phosphotungstate, but amounts of P_2O_5 > this cause uniform but high results owing to the pptn. of (I) alone, the ignition of which gives P_2O_5,24WO_3. L. S. T.

Determination of uranium by isatin-β-oxime. V. Hovorka and V. Sýkora (Coll. Czech. Chem. Comm., 1938, **10**, 182—189).—Addition of isatin-β-oxime to a hot solution of a uranyl salt, followed by addition of excess of NaOAc, gives a quant. pptn. of $UO_2(C_8H_5O_2N_2)_2$, finally converted by ignition into U_3O_8. The method tends to give slightly high results, with an error (for wts. of U_3O_8 from 0·3 to 0·01 g.) of <0·5%. M. R.

Development of electro-drop analysis. V. H. Fritz (Mikrochem., 1938, **24**, 171—178; cf. A., 1938, I, 274).—The significance of the electrolyte and its solvent in the separation of similarly-reacting metals by electro-drop analysis with special reference to Bi and Sb in presence of thiocyanate and in aq. and MeOH solution is discussed. Reagents for the simultaneous detection of several metals, the detection of traces of metallic impurities in pure metals, and the masking of interfering ions are also discussed. L. S. T.

Thermo-regulator. N. Sălăgeanu (Bull. Soc. Roumaine Physique, 1938, **38**, 103—108).—The heating current is interrupted by means of a lever controlled by the position of the Hg meniscus. The disadvantages of using Hg as current carrier are avoided; temp. variations of <0·004° at 28° are recorded. M. R.

Photo-electric thermoregulator. N. N. Afanasiev (Zavod. Lab., 1938, **7**, 234—236).—Apparatus is described. R. T.

Laboratory thermoregulator. H. M. Waddle and R. E. Imhoff (J. Chem. Educ., 1938, **15**, 191—

192).—The thermoregulator described utilises the coiling and uncoiling of a bimetal helix with changes in temp. It can be used in any position to control temp. to within $\pm 0{\cdot}3°$ over a range of 50—225°. L. S. T.

Copper–phosphoric acid thermostat for kinetic measurements. H. C. S. SNETHLAGE (Chem. Weekblad, 1938, **35**, 364).—H_3PO_4 is a suitable liquid for thermostats at high temp. It attacks glass at >150° and also Cu and brass, especially when in motion, but Cu is satisfactory at $\not>160°$ if the metal in contact with rapidly moving liquid is covered with a loose Cu plate. Corrosion is much more severe in presence of H_2O and the acid must be maintained at about 100%. An electrically heated thermostat is described. S. C.

Electric air-heater. M. C. DE MAUNY (Bull. Soc. chim., 1938, [v], **5**, 568—569).—Air is passed over a wound-wire resistance in suitable container. M. R.

Amorphous carbon resistance thermometer-heaters for magnetic and calorimetric investigations at temperatures below 1° K. W. F. GIAUQUE, J. W. STOUT, and C. W. CLARK (J. Amer. Chem. Soc., 1938, **60**, 1053—1060).—The electrical resistance characteristics of finely-divided C at low temp. have been investigated. The resistance of a C ink thermometer at 1·63° K. is 13,700 times that at 293° K. The construction of C thermometer-heaters from lampblack is described. The resistance of a C thermometer has been determined from 293° to 0·129° K. and the degree of reproducibility ascertained. Measurement of the increase of resistance in a magnetic field at 4·2° and 1·5° K. shows a greater val. at the lower temp.; at both temp. it $\propto$ (applied field)^2. The problem of possible heat development by eddy currents within the C particles during measurements requiring the presence of alternating fields is discussed. The resistance of Pt films on glass has been investigated at low temp. in connexion with their use as thermometer-heater leads. E. S. H.

Reference tables for iron–constantan and copper–constantan thermocouples. W. F. ROESER and A. I. DAHL (J. Res. Nat. Bur. Stand., 1938, **20**, 337—355).—From determinations of the thermo-e.m.f. of various Fe and constantan wires against a standard Pt wire (reference junction at 0°) a table of the temp.–thermo-e.m.f. relations of the Fe–constantan couple from −200° to 1000°, which is very close to the table most generally used, has been constructed. The max. deviation of any couple tested was $\not>0{\cdot}75\%$. The table of thermo-e.m.f. given by Adams ("Intern. Crit. Tables," **1**, 58) for the Cu–constantan couple represented closely the mean of the couples tested, and this was adopted as the standard table. Both tables are near to the mean of vals. for, and are easily reproduced by a suitable choice of, the materials most commonly used. Oxidation causes very little drift of the e.m.f. of the Cu–constantan couple, but seriously affects the accuracy of the Fe–constantan junction, which should not be used above 750°. R. C. M.

Accurate determination of dew point. A. W. HIXSON and G. E. WHITE (Ind. Eng. Chem. [Anal.], 1938, **10**, 235—240).—In the apparatus and method described the dew point of confined samples is determined directly by a sensitive photo-electric means of dew observation. The marked hysteresis error characteristic of methods involving continuous temp. change is eliminated. A precision of approx. $\pm 0{\cdot}01°$ at 90% humidity and $\pm 0{\cdot}05°$ at 100% can be obtained. The apparatus is sufficiently sensitive to register the presence of gaseous films adjacent to the mirror of composition somewhat different from the body of gas due to localised cooling at nearly const. pressure. An hypothesis concerning the structure of gaseous films adjacent to the liquid phase is advanced, and the mechanism of dew formation and evaporation is discussed. Possible applications of accurate dew point determinations are considered. L. S. T.

Apparatus for determining b.p. and f.p. of solvents. E. E. CHANDLER (J. Chem. Educ., 1938, **15**, 166). L. S. T.

Light source for microscopy. H. WRIGHTON (J. Roy. Microscop. Soc., 1937, **57**, 260—261).—The new high-pressure "Osira" Hg vapour lamp and its characteristics are described. N. M. B.

Apparatus for comparing luminosity of light sources. A. BLONDEL (Compt. rend., 1938, **206**, 1231—1232).—The apparatus employs a Se photo-electric cell and is suitable for routine checking of incandescence lamps during manufacture. J. A. D.

Sampling visible radiation. R. W. WALLACE (Plant Physiol., 1937, **12**, 647—666).—A suitable arrangement of photo-electric units is described. A. G. P.

Principles of fluorescence microscopy. J. E. BARNARD and F. V. WELCH (J. Roy. Microscop. Soc., 1937, **57**, 256—259).—A descriptive survey. N. M. B.

Apparatus for viewing varying thicknesses of solution with a direct-vision spectroscope. G. A. HARRISON (Biochem. J., 1938, **32**, 933—935).—By means of a plunger arrangement depths $\not>5$ in. thick can be examined using 5 ml. of liquid. A. L.

Objective spectral colorimeter. II. E. LANDT and H. HIRSCHMÜLLER (Z. Wirts. Zuckerind., 1938, **88**, 247—279; cf. A., 1937, I, 534).—The errors inherent in the apparatus and its operation are discussed. Taking due precautions, the error of measurement should not exceed 2%. Typical results are recorded for turbid and clear solutions of sugar products. E. S. H.

Photo-electric colorimeter for determination of silver in used [photographic] thiosulphate baths.—See B., 1938, 733.

Large quartz monochromator for biophysical research. F. M. UBER and S. JACOBSOHN (Rev. Sci. Instr., 1938, **9**, 150—152).—The instrument provides for the simultaneous irradiation of 15 different samples of 100 sq. mm. area and two of 75 sq. mm. area placed horizontally and each exposed to a single λ of the Hg arc spectrum for the range $\lambda\lambda$ 3655—2352 A. The sample holder can be exchanged for a photographic film holder or a calibrated

traversing slit mechanism carrying a thermopile or photo-cell. N. M. B.

Intensifying screens in *X*-ray diffraction work. C. GAMERTSFELDER and N. S. GINGRICH (Rev. Sci. Instr., 1938, **9**, 154—159).—Exposure time-density curves for monochromatic *X*-ray diffraction patterns of liquids are given for a Fluorazure intensifying screen which reduces exposure time and increases intensity by a factor 1—13·3 for Mo $K\alpha$ radiation and 1—4 for Cu $K\alpha$ radiation for increasing intensities or exposure times. With this screen true intensity measurements cannot be made. Curves are also given for two ordinary *X*-ray films in contact and for a new type of double emission film which reduce exposure time and permit true intensity measurements. N. M. B.

Transport of material in sources for spectroscopic analysis. G. O. LANGSTROTH and D. R. MCRAE (Canad. J. Res., 1938, **16**, **A**, 61—74).—When an image of the light source is focussed on the spectrograph slit, the intensity ratio of the lines due to the internal standard and investigated element, respectively, depends on the point in the source from which the examined light is radiated. This ratio may depend so strongly on the nature of extraneous matter in the sample as to vitiate precision measurements. The effects of variations in transport mechanism in the spark discharge can be minimised by addition of excess of a suitable salt (containing an element of low ionisation potential) as spectroscopic buffer, and by choice of an appropriate internal standard element. The mechanism of transport is discussed. E. S. H.

Technique of formation of Hartley figures. Mode of operation. C. DUFRAISSE and J. HOUPILLART (Bull. Soc. chim., 1938, [v], **5**, 309—322).—Defects in the representation of absorption spectra by means of Hartley figures are discussed, and a photographic method of correction of the figures is described. E. S. H.

Experimental conditions for half-shadow polarimetry. R. TSUCHIDA (Bull. Chem. Soc. Japan, 1938, **13**, 353—356).—Optimal conditions for the polarimetry of coloured substances are deduced theoretically. F. L. U.

Loss of definition of *X*-ray photographs by the use of intensifying foils. H. NITKA (Physikal. Z., 1938, **39**, 436—439). A. J. M.

Apparatus for recording photographically the linear expansion of metals. Expansion coefficients of copper and nickel. E. ROSENBOHM (Physica, 1938, **5**, 385—398).—The expansion of a short bar of metal opens a slit on which is focussed an image of the filament of an incandescence lamp and causes a corresponding amount of light to fall on the sensitive part of a Moll thermopile. The current produced is measured by a reflecting galvanometer by projecting the reflected light either on to a screen or on to a photographic plate. In this way, the change in length of the test-piece is magnified 1000 times. The linear expansion coeffs., α, of Cu and Ni have been measured from 0° to 400° and 0° to 520°, respectively. For Cu α increases uniformly but for Ni it shows an irregularity at the Curie point. T. H. G.

Response of barrier-layer cells to *X*-rays of long wave-length. A. E. SANDSTRÖM (Nature, 1938, **141**, 873).—Photo-electric Se cells are susceptible to *X*-rays of λ somewhat <20 A. The photo-e.m.f. is $\sim 10^{-4}$ v. Below 0·9 μ.-amp., the photo-current is a rectilinear function of the intensity. L. S. T.

Scale for determining the refractive indices of molten organic substances. L. KOFLER and H. RUESS (Chem. Erde, 1938, **11**, 590—591; cf. A., 1930, 314; A., 1937, I, 427).—A scale for use by the immersion method consists of a series of 24 fluorite and glass powders with n ranging from 1·4339 to 1·6718. L. J. S.

Simple Wilson chamber for demonstration. G. RATHENAU (Physica, 1938, **5**, 427—429).—The instrument, which is described and figured, is designed for direct observation. It is simple, cheap, and portable. T. H. G.

Vacuum tube control circuit for cloud chambers. J. R. RICHARDSON (Rev. Sci. Instr., 1938, **9**, 152—154).—An improved form of the circuit described by Jones (cf. A., 1937, I, 582) with elimination of the usual motor and cam arrangement. N. M. B.

Scale-of-two counter. H. ALFVÉN (Proc. Physical Soc., 1938, **50**, 538—359).—The counter described is a simplified form of that due to Lewis (cf. A., 1938, I, 101), without chokes and Cu_2O rectifiers. N. M. B.

Improvement in Geiger-Müller tube design. J. L. LAWSON and A. W. TYLER (Physical Rev., 1938, [ii], **53**, 605).—The use of a Cu wire shield to counteract the influence of external light and charged bodies is described. N. M. B.

Circuit for use with Geiger-Müller counters. E. W. YETTER (Physical Rev., 1938, [ii], **53**, 612).—The circuit is similar to that of Neher and of Ruark (cf. A., 1938, I, 277) but the automatically adjustable resistance of a vac. tube is used in series rather than in parallel with the ion counter, and the discharge is cut short by increasing the series resistance to a high val. as soon as the counter discharge begins. N. M. B.

Influence of vapours on the spectral sensitivity curve of photo-electric counters. R. AUDUBERT and J. MATTLER (Compt. rend., 1938, **206**, 1005—1007).—The sensitivity curve of counters with Pt, Au, Ag, CuO, CdS, and Al photocathodes is independent of the nature of the gas or vapour filling the counter. With a CuI cathode, EtOH and $COMe_2$ shift the sensitivity max. from 2150 to 2350 A., probably owing to dissolution of I in the surface layer; in I vapour the max. is at 2100 A. A. J. E. W.

Theoretical efficiency of cylindrical ionisation chambers when used for determining radon by α-particle counting. J. H. J. POOLE (Sci. Proc. Roy. Dublin Soc., 1938, **21**, 609—614; cf. A., 1938, I, 370).—Mathematical. Since the range of α-particles varies only a certain proportion of them will produce sufficient ions to cause a kick on the oscillograph

record. This proportion must be calc. for Rn, Ra-*A*, and Ra-*C'* and corr. for decay of the Rn before recording begins. Good agreement with experimental results is obtained. T. H. G.

Transport of ions in fluid moving with supersonic velocity. V. VOLKOVISKY (Compt. rend., 1938, **206**, 1084—1086).—An apparatus for measuring the rate of diffusion of ions in a high-velocity air blast is described. Its applications to aerodynamic problems are indicated. H. J. E.

Experimental investigation of the second method of Drude. I. V. I. KALININ (Abh. Staatsuniv. Saratov, 1938, **14**, 48—53).—The sensitivity of the method is higher if the liquid, the dielectric const. of which has to be determined, instead of being placed in a condenser, is put in a vessel in which two wires connected with the Lecher wires are dipping. J. J. B.

Apparatus with high resolving power for cosmic rays. R. MAZE (J. Phys. Radium, 1938, [vii], **9**, 162—168).—The system of Neher and Harper (A., 1936, 1084) is developed to give increased resolving power. O. D. S.

Indirect observation of structural changes at high temperatures, using the electron microscope. J. P. SELISSKI (Zavod. Lab., 1938, **7**, 114—115).—Transformation of α- into γ-Fe, or the reverse change, may be followed with the aid of an electron microscope. R. T.

Mass spectrometer with improved focussing properties. W. BLEAKNEY and J. A. HIPPLE, jun. (Physical Rev., 1938, [ii], **53**, 521—529).—A discussion of the use of crossed electric and magnetic fields indicates that this arrangement has perfect focussing properties depending only on the m/e of the ion selected and not on the velocity or direction of the charged particles entering the analyser. The two types of path (curtate and prolate cycloids), the construction of the projection of the path (a trochoid) in the plane perpendicular to the magnetic field, and the design and construction of apparatus for the two types of path are discussed, and typical mass-spectra (for C_2H_6) are shown. N. M. B.

Positive ion source for nuclear research. J. S. ALLEN (Rev. Sci. Instr., 1938, **9**, 160).—In the arrangement described the distance between the anode and filament is short to ensure easy starting. A glass shield confines the arc to a small region near the probe. N. M. B.

Selenium photo-cells and their use. W. BEHRENDT (Z. tech. Phys., 1938, **19**, 92—97).—The characteristics and uses of a no. of types of cell are reviewed. A. J. E. W.

Method for preparing glass electrodes. M. L. NICHOLS and J. M. SCHEMPF (Ind. Eng. Chem. [Anal.], 1938, **10**, 286).—The procedure described gives a sensitive, durable electrode which can be used with an ordinary galvanometer. L. S. T.

Vacuum-tight seal for electrodes with high insulation. R. D. BRADFIELD (Canad. J. Res., 1938, **16, A**, 76). E. S. H.

Cathode-ray furnace with regulable electrodes. F. TROMBE (Bull. Soc. chim., 1938, [v], **5**, 712—715; cf. A., 1934, 859).—The discharge tube described comprises a SiO_2 bulb in which the Al electrodes are held in side tubes at about 45° to one another, so that two beams of electrons converge on a W anticathode. The materials, the effect of electrons on which it is desired to investigate, can either be submitted to direct bombardment in a shallow dish on the anticathode, or can be shielded from direct bombardment by enclosure in a deeper vessel. J. W. S.

Direct-reading apparatus for measuring magnetic fields. R. SERVANT and B. TSAÏ (Compt. rend., 1938, **206**, 1172—1174).—The instrument consists of a coil carrying a const. current, rotating against a hairspring about an axis perpendicular to the magnetic field; the deflexion of the coil is read with a suitable pointer and scale. Accuracy to 1% is claimed, and the instrument may be used for widely varying field strengths by adjustment of the current through the coil. A. J. E. W.

Automatic zero burette. P. REISS (Bull. Soc. chim., 1938, [v], **5**, 569—571).—The burette is provided with a tap allowing two-way communication to a titration flask or to a reservoir. Air enters the reservoir by a vertical tube bent at right angles under the surface of liquid at a suitable level. M. R.

High-vacuum gas analysis apparatus.—See B., 1938, 612.

Apparatus for detection of gas traces. Hydrogen sulphide.—See B., 1938, 736.

Compensational polarographic method. J. S. LIALIKOV (Zavod. Lab., 1938, **7**, 24—29).—A compensational method is described. R. T.

Mercury U-gauge. A. ZIMMERLI (Ind. Eng. Chem. [Anal.], 1938, **10**, 283—284).—A modification designed to overcome the disadvantages of the usual U-shaped Hg manometer for measuring moderately low pressures is described. L. S. T.

Bottle-shaking apparatus. G. W. SMITH (Ind. Eng. Chem. [Anal.], 1938, **10**, 282—283).—The device consists essentially of a circular platform mounted at an angle of 15° on a vertical motor-driven shaft. Six 125-ml. Erlenmeyer flasks are shaken at a time. L. S. T.

Reciprocating laboratory shaker. E. R. SCHWARZ and L. SHAPIRO (Ind. Eng. Chem., 1938, **10**, 281—282).—The shaker is suitable for washing fabrics. Air is quickly displaced; wetting is complete in a few sec. and washing in <15 min. L. S. T.

Simple high-vacuum release valve. R. JACKSON and A. G. QUARRELL (J. Sci. Instr., 1938, **15**, 208).—A Schrader tyre valve has been adapted to admit air to all-metal vac. apparatus. J. A. D.

Constant-pressure valve. K. S. WILLSON (Ind. Eng. Chem. [Anal.], 1938, **10**, 279—280).—The valve described permits removal of gas at a const. pressure independent of the back pressure on the exhaust line. It also serves as a safety manometer to prevent excessive pressure in a system. L. S. T.

Pressure regulator. F. TROMBE (Bull. Soc. chim., 1938, [v], **5**, 710—712).—A regulator designed

to give const. pressure reduction as a gas passes from one vessel to another comprises a U-tube, the amount of Hg in which can be regulated, one side of which is connected to each vessel. A float on the Hg in the limb connected to the vessel at higher pressure serves to close a connexion between the two vessels when the pressure difference is too low. J. W. S.

Sensitive manostat for low gas pressures. T. SOLLER, S. GOLDWASSER, and R. A. BEEBE (J. Amer. Chem. Soc., 1938, **60**, 1265—1266).—A correction. The photo-electric relay circuit described (A., 1936, 1355) should include a grid leak. E. S. H.

Surface viscosimetry. W. D. HARKINS and J. G. KIRKWOOD (J. Chem. Physics, 1938, **6**, 298).—A reply to criticism (cf. Dervichian and Joly, A., 1938, I, 135). W. R. A.

Separation of gaseous isotopes by diffusion. R. SHERR (J. Chem. Physics, 1938, **6**, 251—259).—The isotopic separation factors per pump in a set of Hg diffusion pumps have been determined for Br in MeBr (1·005), C in CH_4 (1·107), O in O_2 (1·045), O in H_2O (1·073), Ne (1·198), and A (1·154). Theoretically derived formulæ for enrichment are discussed. Attempts to modify the pumps and increase their efficiency are described. W. R. A.

Crystal model construction. K. M. SEYMOUR (J. Chem. Educ., 1938, **15**, 192—194).—The construction of models of LiCl, CaF_2, CdI_2, etc. from sponge rubber balls and oak doweling is described. L. S. T.

Combination funnel support and burette clamp. P. S. CHEN (J. Chem. Educ., 1938, **15**, 190).—The hand screw on the usual type of clamp is replaced by a screw with a ring at one end. L. S. T.

Determination of the vapour densities of indigo and other organic compounds by means of a spoon gauge. C. E. DENT and R. P. LINSTEAD (J.C.S., 1938, 715—717).—The pressures exerted by a known wt. of substance completely volatilised in a known vol. at measured temp. have been measured. The gauges used were sensitive to pressure differences of 1 mm. Mol. wts. found were: phthalimide 147·5 ($C_8H_5O_2N = 147$), indigo 257 ± 9 ($C_{16}H_{10}O_2N_2 = 262$), phthalonitrile polymeride 396 ± 25[$(C_8H_4N_2)_3 = 384$]. M. R.

Water as a reference standard for ebulliometry. W. SWIENTOSLAWSKI and E. R. SMITH (J. Res. Nat. Bur. Stand., 1938, **20**, 549—553).—The properties of H_2O are discussed with reference to its suitability as a primary standard for comparative ebulliometric measurements. The influence of small differences in isotopic composition are shown to be negligible. Equations are given for obtaining the b.p. of H_2O to 0·001° at any pressure between 660 and 860 mm., and vice-versa. D. F. R.

Ultracentrifuge. J. W. MCBAIN and F. A. LEYDA (Nature, 1938, **141**, 913—914).—The ultracentrifuge designed is a modification of the air-driven spinning top; this procedure dispenses with an optical system, and depends on direct analysis by a suitable method of the liquid after centrifuging. Results obtained with the apparatus for the sedimentation const. of ovalbumin agree with those obtained with the Svedberg apparatus. L. S. T.

Methyl methacrylate as a laboratory tool. E. C. COLE (Science, 1938, **87**, 396—398).—Uses are described. L. S. T.

Maintaining transparency in glass observation windows. C. W. OCKELFORD (J. Sci. Instr., 1938, **15**, 190—193).—Difficulties experienced in measuring the optical density of smoke columns, due to deposits from the smoke settling on to the glass windows, were removed by maintaining the windows at a temp. 50° > that of the smoke column. J. A. D.

Silvering glass. F. E. J. OCKENDEN (J. Sci. Instr., 1938, **15**, 206—208).—Formulæ are given for the two components of a silvering mixture. Conc. HNO_3 is used for cleaning the articles to be silvered; NaOH or KOH is not recommended. O_2 dissolved in the silvering solutions oxidises the final deposit if not previously removed by gentle boiling of the respective solutions before mixing. Full practical detials are given. J. A. D.

Distillation apparatus for water with automatic feed and removal of residue. P. STADLER (Chem.-Ztg., 1938, **62**, 369). E. C. S.

Aids to vacuum distillation. T. S. GARDNER (J. Chem. Educ., 1938, **15**, 194).—A sliver of glass fused on to the end of the tube leading from the distilling flask breaks up drops of liquid that would be entrained and causes their return to the flask. A special form of seal prevents breakage of the condenser when the apparatus is disconnected. L. S. T.

High-vacuum fractional distillation without gravitational reflux. G. VON ELBE and B. B. SCOTT (Ind. Eng. Chem. [Anal.], 1938, **10**, 284—286).—The mixture to be fractionated is placed in a long, evacuated glass tube along which a temp. gradient is maintained for a short distance by a thermostat system. The mixture tends to accumulate at the low-temp. end of the gradient and by pulling the tube slowly and uniformly through the gradient in the direction towards the warm end, the mixture is made to distil continuously within the gradient and to separate into its components. The method is illustrated by the separation of *p*- and *m*-xylene in a 0·01—0·1-c.c. sample. L. S. T.

Apparatus for vacuum [fractional] distillation. L. RAMBERG (Svensk Kem. Tidskr., 1938, **50**, 107—111).—A receiver in which losses due to incomplete condensation are <2·5% is described. M. H. M. A.

Appliance for precipitation with hydrogen sulphide, and for detection of gases. C. N. POTSCHINOK (Ukrain. Chem. J., 1938, **13**, 86—90). R. T.

Carbon monoxide indicators.—See B., 1938, 736.

[Laboratory] experiments dealing with rates of dissolution [of sodium chloride]. G. W. GLEESON (J. Chem. Educ., 1938, **15**, 187—190). L. S. T.

Geochemistry.

Geochemical data for the origin of the Melitopol natural gas reservoirs. J. V. Gretschni (Ukrain. Chem. J., 1938, **13**, 91—104).—The origin of the deposits is discussed. R. T.

Analysis of the Royal Spring at Kostrivnica. S. Miholić (Bull. Soc. Chim. Yougoslav., 1937, **8**, 183—192).—Analytical data are recorded. R. T.

Decompositions in shallower waters of a lake in summer and the supply of oxygen from the atmosphere. K. Sugawara (Proc. Imp. Acad. Tokyo, 1938, **14**, 57—60).—In warm, shallow H_2O, decomp. is more rapid than assimilation of O_2 and leads to reduction of O_2 content. E. S. H.

Ecology of the Tamar estuary. III. Salinity and temperature conditions in the lower estuary. A. Milne (J. Marine Biol. Assoc., 1938, **22**, 529—542).—Salinity and temp. conditions were studied at various points in the estuary in relation to time of year and state of tide. On a rising tide the more saline H_2O bulges up towards the surface. On a falling tide the fresher H_2O bulges downwards. Bottom-living organisms experience smallest salinity range near high-H_2O mark and greatest at low-H_2O mark. At high-H_2O mark the variation is in the higher part of the salinity range. The period of fluctuating salinity is shorter in the upper part of the inter-tidal zone. Organisms thus meet with more favourable salinity conditions the higher they live in the inter-tidal zone. In the surface H_2O the average salinity decreases up-river but the range of variation increases. A. D. H.

Re-examination of cliftonite. M. H. Hey (Min. Mag., 1938, **25**, 81).—An *X*-ray photograph of a small cube of graphite from the Youndegin siderite shows it to be an oriented pseudomorph [after diamond ?] with the *c*-axes o graphite parallel to the three [001] axes of the cube. L. J. S.

Hornblendes from the Glen Tilt complex, Perthshire. W. A. Deer (Min. Mag., 1938, **25**, 56—74).—Detailed chemical analyses with optical data are given of 9 hornblendes from the various basic rocks of the complex. Formulæ are deduced and the results plotted. A relationship is shown between the SiO_2 content of the hornblendes and that of the rocks in which they are contained. The green and brown colours of hornblendes are discussed in relation to the Fe_2O_3 : FeO ratio and the presence of TiO_2 or Ti_2O_3. L. J. S.

Russellite, a new British mineral. M. H. Hey and F. A. Bannister (Min. Mag., 1938, **25**, 41—55).—The mineral was found sparingly as yellow pellets in the concentrates of W ore at Castle-an-Dinas mine, Cornwall. Micro-analyses agree approx. with Bi_2O_3,WO_3; ρ 7·18—7·43. *X*-Ray photographs show it to be tetragonal, with space-group D_{2d}^{12} or D_4^{19} and cell size *a* 5·42, *c* 11·3 A. Artificially prepared material with the approx. composition $Bi_2O_3,2WO_3$, ρ 7·97—8·12, is also tetragonal with a similar structure. It is suggested that these are mixed crystals $(Bi_2,W)O_3$, rather than Bi tungstates. An appendix by A. Russell describes the mode of occurrence and associated minerals. L. J. S.

Molybdenite-bearing pegmatites and granites from West Tatra. L. Chrobak (Bull. Acad. Polonaise, 1938, **A**, 120—125).—Mineral content, and petrological structure, texture, and origin are described, with chemical analyses by *X*-ray methods. The MoS_2, hitherto unknown in this region, contains small amounts of Cl, Fe, Ba, Ca, K, Cu, Pb, and Bi. It occurs with muscovite and quartz in idiomorphic hexagonal plates, in thin ledges in felspar, or embedded in limonite. Halos in biotite are due to α-rays of range 20 and 33 μ. derived from Rn and Ra-*F*, and Ra-*C'*, respectively. I. McA.

Metamorphosis of amphibolitic rocks from Tatra. S. Kreutz (Bull. Acad. Polonaise, 1938, **A**, 116—119).—Petrological characteristics are described. Chemical and mineralogical analyses, with photomicrographs, indicate the nature of the metamorphosis (which includes pleochroic halos of radioactive origin) due chiefly to tectonic movement. I. McA.

Sulphide silver minerals—their pyrosynthesis and their identification by selective iridescent filming. A. M. Gaudin and D. W. McGlashan (Econ. Geol., 1938, **33**, 143—193).—Argentite, proustite, smithite, pyrargyrite, miargyrite, matildite, and stromeyerite have been synthesised by heating the appropriate elements in an Fe bomb at temp. up to 800°. Four other Ag compounds synthesised are probably identical with pearcite, stephanite, polybasite, and tapalite. The phases obtained have been differentiated by selective iridescent filming with a solution composed of one vol. of 2% I–MeOH solution and one of conc. H_2SO_4. Other sulphides synthesised include chalcocite, covellite, famatinite, tetrahedrite, chalcostibite, stibnite, galena, enargite, and bismuthinite. Phase diagrams of the systems Ag–As–S, Ag–Sb–S, Ag–Bi–S, and Ag–Cu–Sb–S, all with excess of S, are reproduced and discussed, and photo-micrographs of the phases are given. Corrections in the accepted formulæ for some of the minerals are proposed. Colours obtained with the filming solution and the various sulphides are tabulated, and provide a key for their identification. L. S. T.

Bauxites. Z. N. Nemova (Trans. Petrograph. Inst. Acad. Sci. U.R.S.S., 1934, **6**, 485—489).—Analyses are recorded. Ch. Abs. (*p*)

Chemical characterisation of Tauz marl. I. O. Alexandrov (Ukrain. Chem. J., 1938, **13**, 80—85).—Analytical data are recorded. R. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

AUGUST, 1938.

Axiality of light emission of the hydrogen atom in the electric field. J. STARK, R. RITSCHL, and H. VERLEGER (Physikal. Z., 1938, **39**, 503—517).—The intensity ratio of the components of the H lines in positive rays under the action of an electric field has been investigated under various conditions. With the exception of the ± 2 components of H_α and H_β the long-wave components are more intense than the short-wave when the applied field is in the same direction as the positive rays. This dissymmetry is reversed if the directions of the field and positive rays are opposite. The pressure of gas alters the degree of dissymmetry, and in the case of opposite directions of field and rays the dissymmetry decreases with decreasing pressure. In the case of light emitted when positive rays pass from a space where the gas pressure is about 5 mm. to one where it is very low, the intensity ratios are much smaller, and the dissymmetry is not reversed if the directions of field and rays are opposite. The effect in a transverse field has also been investigated. The polarisation of H_α is determined under various conditions in both the longitudinal and transverse fields. A. J. M.

Light emission and ionisation of the moving state of hydrogen atoms in strong electric fields. J. STARK and R. RITSCHL (Physikal. Z., 1938, **39**, 517—522).—It is shown that ionisation by collision is rendered more easy under the action of an external electric field in the case of the anodic moving state of the H atom than for the cathodic state. The electric field is not directly responsible for the effect. A. J. M.

Detection of negative dispersion in electrically excited helium. M. KRUSE (Z. Physik, 1938, **109**, 312—331).—Negative dispersion in electrically excited He was detected by the "hook" interference method of Roshdestvenski, at several λλ corresponding with $2s^3S$ and $2p^3P$ transitions of the He triplet system. A light source emitting a continuous spectrum in the region of 3889 A. is described. From the results, the approx. increase in packing no. for the states of the He mol. is calc. H. C. G.

Spectrum of N_2 and CO in Lyman region. V. M. TSCHULANOVSKI and S. I. GASSILEVITSCH (Physikal. Z. Sovietunion, 1937, **12**, 83—88).—Improvements in the technique of exploring the Lyman region have enabled the resolving power to be increased to 40,000. Preliminary λ vals. for 27 band heads of the CO mol. are given, and the mol. spectrum of N_2 is discussed. J. A. D.

Formation and excitation of molecule ions in active nitrogen. U. STILLE (Z. Physik, 1938, **109**, 491—502).—A new theory of the excitation of negative bands in active N (due to Kaplan) is discussed. L. G. G.

Atmospheric sodium. J. CABANNES, J. DUFAY, and J. GAUZIT (Compt. rend., 1938, **206**, 1525—1528; cf. A., 1938, I, 285).—Previous observations are reviewed and discussed. The luminescent layer is ~130 km. above the earth's surface, the intensity of the D_1D_2 doublet corresponding with 2×10^{11} $^2P \rightarrow {}^2S$ transitions per sec. per cu. m. The luminescence is attributed to cosmic dusts or meteorites, which may account for the deposition of $2{\cdot}5 \times 10^7$ atoms of Na per sec. per sq. m. of the earth's surface. This is in agreement with the appearance of meteorites at an altitude of ~130 km. The possibility of attributing certain lines in the night sky spectrum to Ca and Al, which may also have meteoric origin, is suggested. A. J. E. W.

Polarisation of the resonance radiation of Na_2 vapour. P. PRINGSHEIM (Physica, 1938, **5**, 489—494).—Observations on a singlet and a doublet series in the Na resonance spectrum, excited at 320° by light from a Cd arc, show that the lines in these series are 40% and 12% polarised, respectively, in fair agreement with theory. Addition of He reduces the degree of polarisation in each case, and causes emission of unpolarised D lines. A. J. E. W.

Revision of Al I terms. R. SCHMID, L. GERÖ, K. LÖRINCZI, and G. NEU (Nature, 1938, **141**, 1017).—The seven Al I lines (data given) obtained in spectrograms of an interrupted Al arc are due to a $^4P \rightarrow {}^4P$ transition and not to a ^2D–^2P transition (A., 1929, 1206). The term-val. of $3s3p^2\ ^2D$ must be dropped. L. S. T.

Zeeman effect in an anomalous series of argon. P. JACQUINOT (Compt. rend., 1938, **206**, 1635—1638).—Measurements on lines in the p^5ns series are recorded. The results are not in agreement with Houston's theory (A., 1929, 480). A. J. E. W.

Low terms in Co VI. I. S. BOWEN (Physical Rev., 1938, [ii], **53**, 889—890; cf. A., 1938, I, 53).—Full data and classifications for about 100 lines and 44 term vals. are tabulated. N. M. B.

Quadrupole moment of $^{83}_{36}Kr$ and $^{131}_{54}Xe$ and mechanical moment of $^{83}_{36}Kr$. H. KORSCHING (Z. Physik, 1938, **109**, 349—357).—From measurements on the Kr I and the Xe I lines in the near infra-red the quadrupole moments of $^{83}_{36}Kr$ and $^{131}_{54}Xe$ are $0{\cdot}04 \times 10^{-24}$ and $\leq 0{\cdot}03 \times 10^{-24}$ cm.^{2}, respectively. The mechanical moment of $^{83}_{36}Kr = 9/2$. These results are included in a table of all known quadrupole moments to date. L. G. G.

Absorption bands of rubidium and cæsium in the presence of foreign gases. N. T. Ze and C. Shang-Yi (J. Phys. Radium, 1938, [vii], **9**, 169—170).—In the presence of He, Ne, A, N_2, and H_2 narrow and diffuse absorption bands appear on the short-λ side of the second member of the principal series of Rb and Cs. The position and magnitude of the band depend on the gas employed. The breadth of these bands increases in the order Ne, N_2, He, H_2, and for the same gas is greater for Rb than for Cs. The intensity of the band increases with concn. of alkali and of gas. W. R. A.

Theory of the forbidden mercury line 2655·8 A. (6^3P_0—6^1S_0). W. Opechowski (Z. Physik, 1938, **109**, 485—490).—The intensity ratios of the components of the hyperfine structure of this line, and the ratio of their total intensity to that of the resonance line 2537 A., are evaluated. The derived results are in agreement with the conception of interaction between the electron envelope and the nuclear magnetic moment. L. G. G.

Effect of oxides and impurities on metallic arc reignition. J. D. Cobine (Physical Rev., 1938, [ii], **53**, 911).—Experiments on Cu cathodes confirm the conclusions of Suits (cf. A., 1938, I, 293) on the necessity of oxide on the cathode to establish a stable arc. N. M. B.

Metallic spectra obtained using shattering explosives. A. Michel-Lévy and H. Muraour (Compt. rend., 1938, **206**, 1566—1568; cf. A., 1937, I, 250).—The spectrum of the flash accompanying detonation of a $C(NO_2)_4$–PhMe mixture in a cavity in a metal block contains arc lines and occasionally a few weak spark lines of the metal. Many absorption lines, generally of the non-ionised metal, are also observed in the continuum. A. J. E. W.

Stark effect on multiple lines. W. Lochte-Holtgreven (Z. Physik, 1938, **109**, 358—373).—Tables are given for the relative term displacements of the Stark effect components of multiple lines up to septets; intensities and polarisation of the components are also given. L. G. G.

Atomic lines in the spectrum of Antares. D. N. Davis (Astrophys. J., 1938, **87**, 335—351).—Evidence for the presence of H, Na, Mg, Al, Si, Ca, Ca^+, Sc, Sc^+, Ti, Ti^+, V, V^+, Cr, Cr^+, Mn, Fe, Fe^+, Co, Ni, Cu, Zn, Sr, Sr^+, Yt, Yt^+, Zr, Zr^+, Ru, Ba^+, La^+, Ce^+, Pr^+, Nd^+, Sm^+, Eu^+, Gd^+, and Dy^+ from at. lines has been obtained. Line counts and max. intensities are summarised. Mol. data established the presence of B, C, N, O, and F. H lines are excessively strong, and Yt lines strong. The unusual strength of the Ca^+, Ba^+, and Sr^+ lines must be due largely to the low surface gravity and the great extent of the atm. of Antares. L. S. T.

Compton scattering of radiation within a star. A. B. Severni (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 45—48).—Mathematical. The influence of Compton scattering on the total opacity of stellar matter is examined. N. M. B.

Experimental verification of the quantum mechanical dispersion theory by reflexion and diffuse scattering of X-rays from zinc. W. A. Bruce (Physical Rev., 1938, [ii], **53**, 802—806).—The F vals. obtained in the powder crystal experiments of various investigators, when corr. by the temp. factor given by experiments on diffuse scattering, can be used to verify Hönl's formula for the X-ray scattering power of an atom for λλ near the absorption edge. All existing data on the at. structure factor (f) vals. of Zn are in good agreement when corr. by the temp. factor and the Hönl Δf. Full data are tabulated. A set of f vals. for Zn shows that there is electron distortion, and evidence is given that the distortion of the electron atm. extends deeper into the atom than the valency electrons. N. M. B.

Laws governing the glowing anodic envelope and their relation to those for the striated positive column in hydrogen and nitrogen. A. Günther-Schulze, W. Bär, and H. Betz (Z. Physik, 1938, **109**, 293—309).—The glowing anodic envelope is formed in H_2 under sharply defined discharge conditions, and takes the form of concentric rings or figures consisting of patches of great luminosity. The relation between these figures, c.d., and gas pressure has been measured and the phenomenon is explained in terms of the min. discharge voltage principle. These theoretical considerations led to the experimental production of the phenomenon in N_2. The relation between the anodic glow and the striations of the positive column is discussed. H. C. G.

Mode of operation of the hollow cathode. A. Lompe (Z. Physik, 1938, **109**, 310—311).—The relationship between curvature of the cathode surface, cathode voltage, c.d., and gas pressure is discussed. H. C. G.

Simple relation in the glow discharge. Y. Kasiwagi (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 461—476).—From photographs of the steady discharge in N_2 at 0·1—0·5 mm. Hg p in a cylindrical tube, with various electrodes (121 combinations of 11 metals) and terminal voltages (V), the relation $Bk^2 = V - nu - V_0$ has been established, where n is the no. of striæ, u the ionisation potential (16 v.), and k the distance from cathode to vertex of positive column. The const. B varies with p and tube diameter. The const. V_0, dependent only on the electrode metals, $= V_C + V_A +$ const., where V_C and V_A are interpreted as the normal fall in cathode and anode potentials, respectively. Vals. of V_C are partly confirmed by Rottgardt's data. I. McA.

Theoretical determination of Townsend coefficient. S. Moralev (Physikal Z. Sovietunion, 1937, **12**, 89—104).—The coeffs. of vol. ionisation are calc. theoretically for pure gases and for gas mixtures, taking into account elastic and inelastic collision processes etc. The ionisation coeff. can be represented by $\alpha = \phi[(E/p),K]$ where E is the field strength, p the pressure, and K the energy losses of the electrons. The variation of α with the concn. of A in the mixtures A–N_2, A–Hg, and A–Hg–N_2 has been determined. J. A. D.

Photo-electric properties of evaporated bismuth films. A. H. Weber (Physical Rev., 1938, [ii], **53**, 895—899).—Investigations by Du Bridge's method (cf. A., 1932, 209) of Bi films deposited on

glass by evaporation in vac. show that the photo-electric emission and threshold λ increase with film thickness to a limiting val. Good agreement with theory is obtained for the temp. range −53·8° to 24·4°, but not for higher temp. The measured max. threshold λ was between 2564 and 2600 A., and the min. val. corresponding with a glass surface thinly spattered with Bi was between 2443 and 2506 A. Exposure to possible gas contamination showed little effect. N. M. B.

Evaporation of atoms, ions, and electrons from tungsten. A. L. REIMANN (Phil. Mag., 1938, [vii], **25**, 834—848).—Data are recorded. The present theory of positive-ion emission is regarded as being too simple. A variable surface factor, which has an important effect on ion emission without affecting appreciably electron emission or evaporation, should be taken into account. H. J. E.

Relation between contact potential and work of escape. W. HEINZE (Z. Physik, 1938, **109**, 459—471).—The contact potentials of W and Ta in vac. were measured and data compared with the work of electron escape derived from the emission equation. Results are in agreement with the theory that the contact potential of two conductors in vac. = difference between their works of electron escape. L. G. G.

Theory of spiral orbits of the electron in a coulomb field. J. FRENKEL and J. ROJANSKI (Physikal. Z. Sovietunion, 1938, **13**, 181—197).—Mathematical. O. D. S.

Conception of the corpuscle. Application to heavy electrons. J. L. DESTOUCHES (Compt. rend., 1938, **206**, 1281—1284).—The definition of a corpuscle and the nature of the heavy electron are discussed. A. J. E. W.

Process of discharge and ionic efficiency in the positive-ray discharge. C. HAILER (Naturwiss., 1938, **26**, 382; cf. A., 1938, I, 222).—Further reference is made to the positive-ray tube as a source of ions for at. transmutation experiments. A. J. M.

Low-temperature thermal source of Li ions. H. LU (Physical Rev., 1938, [ii], **53**, 845—846).—At temp. as low as 700° amblygonite, $LiAl(F,OH)PO_4$, emits Li ions, the current obtained being >10 times that from spodumene at 1000°. The time–current curve shows resolution of the ^7Li and ^6Li isotopes, and the emission reaches a max. after about 6 hr. N. M. B.

Direct evidence for the N_2H^+ ion in the discharge reaction between N_2 and H_2. G. C. ELTENTON (Nature, 1938, **141**, 975—976).—Examination by means of a mass spectrograph shows that N_2H^+ is produced abundantly when a mixture of $N_2 + H_2$ is bombarded with electrons. N_2H^+ appears to owe its origin to N_2^+ and not to H_2^+, and the reaction commences at the ionisation potential of N_2. The formation of N_2H^+ is only the first stage in the production of NH_3. The probability of its formation is > that of H_3^+. L. S. T.

Formation of negative ions at surfaces. F. L. ARNOT and C. BECKETT (Nature, 1938, **141**, 1011—1012; cf. A., 1938, I, 4, 274, 337).—The negative ion emitted from a metal surface by bombardment with positive ions need not necessarily be of the same element as the bombarding ion. Five peaks (mass nos. approx. 16, 24, 32, 37, and 44) of light negative ions are obtained by the mass spectrograph when the electrodes are bombarded by positive ions of A, N, or Hg, and the negative ion curves produced by each type of positive ion are practically identical. No negative ions of N are formed. After treatment of the electrode surfaces with O_2, bombardment by positive ions of Hg produces O^- and O_2^-. The peaks reported above probably arise in a similar way from other gases and vapours either occluded in the metal or adsorbed on its surface. L. S. T.

Improvement of resolving power of mass spectrographs. R. HERZOG and V. HAUK (Physikal. Z., 1938, **39**, 463—466).—The resolving power of mass spectrographs can be improved by substituting for the slit a diminished image of a slit. This can be done by means of a small radial electric field applied before the usual electric field of the spectrograph. The new conditions for double focussing are given, and an expression for the resolving power is deduced. The advantages and disadvantages of the method are discussed. A. J. M.

At. wt. of potassium from sunflower seed hulls.—See A., 1938, III, 631.

Range of occurrence of stable isotopes. H. BROWN (Physical Rev., 1938, [ii], **53**, 846).—Regularities in the A–$2Z$,Z (Harkins) diagram are discussed, and 23 stable undiscovered isotopes are predicted. N. M. B.

Relation between atomic number and isotopic number for stable isotopes. G. E. GIBSON and H. BROWN (Physical Rev., 1938, [ii], **53**, 846; cf. preceding abstract).—Curves for A–$2Z$,Z for all stable isotopes and for all odd and even vals. of the isotopic no. amplify the regularities previously discussed. N. M. B.

Quantum reactions in the biological action of rays. K. SOMMERMEYER (Z. Physik, 1938, **109**, 332—340).—The definition of collision no. and its relation to λ and half dose val. in biological radiation reactions are considered theoretically. H. C. G.

Preliminary measurements of the heat produced by the internal deformation of a block of lead influenced by its own weight. W. ŚWIENTOSŁAWSKI, L. KEFFLER, and J. SALCEWICZ (Bull. Acad. Polonaise, 1937, A, 546—554; cf. A., 1932, 137; 1934, 623, 748, 938; 1937, I, 478).—The microcalorimetry of long-lasting processes (*e.g.*, radiology) is discussed, with special reference to the spontaneous heat produced in a suspended block of Pb due to its deformation over 20 days. I. McA.

Electric effluvium, atmospheric aërosol, and the measurement of the radioactivity of the atmosphere. G. ALIVERTI (Nuovo Cim., 1938, **15**, 66—67).—The method of measuring atm. radioactivity previously described (A., 1932, 926) is discussed further. O. J. W.

Internal conversion of electrons of actinon. W. E. BENNETT (Proc. Camb. Phil. Soc., 1938, **34**,

282—289).—The energies of the secondary β-rays arising from actinon by internal conversion have been measured by the cloud chamber method. The internal conversion coeffs. were in agreement with the previous experimental vals. Tracks of Auger electrons associated with the secondary electrons were found. F. J. L.

Formation of positron-electron pairs by γ-radiation. K. ZUBER (Helv. Phys. Acta, 1938, **11**, 207—218; cf. A., 1937, I, 437).—The formation of positron-electron pairs in A by means of γ-rays from radio-Th has been studied using an automatic Wilson chamber. Pairs probably due to γ-radiation of energies 1·7—2·1 and 3·0—3·4 M.e.v. are observed, the latter corresponding with 9 quanta per 100 quanta of 2·62 M.e.v. The mean energy difference between the positrons and electrons, and the distribution of the angles between the γ-rays and the electron and positron trajectories, are in accord with the Bethe–Heitler theory (A., 1934, 1150). A. J. E. W.

Angular distribution of pairs in krypton. L. V. GROSCHEV and I. M. FRANK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 49—54).—The angular distribution of pair components was investigated by stereocomparator determinations of the spatial position of the vertex of the pair, of one point on the electron track, and of one on the positron track. Results are tabulated and discussed. N. M. B.

Efficiency of neutron production by deuterium canal-rays. W. DE GROOT and F. M. PENNING (Physica, 1938, **5**, 512—519).—The effective cross-sections, σ, for D, Li, Be, and C, as a function of the velocity v of impinging deuterons, are derived, using previous experimental data (A., 1937, I, 438). It is found that $\sigma \propto v^m e^{y}$, where $0 > m > -2$ and $y = 2\pi zZc/137v$ (z being the no. of unit charges on bombarding particles of mass Z). Using this formula the neutron yields have been extrapolated to lower deuteron energies. Other published results are in agreement with the formula if $m = -1$. A. J. E. W.

Elastic and inelastic scattering of fast neutrons. D. C. GRAHAME and G. T. SEABORG (Physical Rev., 1938, [ii], **53**, 795—801).—Cross-sections for the combined processes of absorption and inelastic scattering of fast neutrons ($\geqslant$4·5 and $\geqslant$7 M.e.v.), measured for a no. of elements by the use of absorbing cylinders and Al or Fe detectors, show a smooth increase with increasing at. no. For neutrons of energies $\geqslant$7 M.e.v. the ratio of these cross-sections to the cross-section for absorption + total scattering is approx. const. at about 0·4. The existence of a scattering of fast neutrons in which little or no energy is lost is demonstrated experimentally and approx. cross-sections are obtained. Cross-sections for an "effective absorption" of medium fast neutrons are smaller than those for the faster neutrons and show a max. for at. no. about 50 and a marked decrease for the heaviest elements (cf. A., 1937, I, 593). N. M. B.

Absorption of group *A* neutrons in silver. H. PAXTON (Nature, 1938, **141**, 971—972).—An absorption curve for group *A* neutrons, from Rn + Be in paraffin, in Ag with thin detectors (0·01 to 0·006 g. per cm.^{2}) is reproduced. The points for zero and 0·0058 g. per cm.^{2} absorption give a min. val. of 59±19 cm.^{2} per g. for the absorption coeff. L. S. T.

Yield and energy of neutrons from the nuclear reaction $^2_1D + ^2_1D = ^3_2He + ^1_0n$. E. BALDINGER, P. HUBER, and H. STAUB (Helv. Phys. Acta, 1938, **11**, 245—268).—A canal-ray tube for the production of deuterons, with associated ionisation chamber, amplifier, and recording oscillograph, is fully described. Using a D_3PO_4 target the apparatus is equiv. as a neutron source to ~0·5 g. Ra + Be, the total neutron yield being $1·15 \times 10^7$ per sec. using 130 kv. deuterons. The yield referred to a pure D target and 100 kv. deuterons is one neutron per 8×10^6 deuterons. The energy of the neutrons at 51° to the 130 kv. deuteron beam is 2·6 M.e.v., the energy yield of the D + D reaction being 3·1 M.e.v. The variation of the yield with the accelerator voltage and deuteron current has been investigated. A. J. E. W.

Loss of neutrons by neutron bombardment and the radioactive isotopes of scandium. J. M. CORK and R. L. THORNTON (Physical Rev., 1938, [ii], **53**, 866—868).—The bombardment of Li by 6·3 M.e.v. deuterons yields neutrons of energy up to 20 M.e.v., which in turn are able to produce disintegrations by the ejection of two neutrons from bombarded nuclei. In the case of Sc, evidence is obtained by varying the energy of the incident neutrons and observing the ratio of the 4 hr. and 53 hr. radioactivities produced that these are due to isomerides of ^{44}Sc rather than to the ejection of three neutrons from the excited nucleus. The excitation function for the ejection of two neutrons is studied for various elements by observing the activity produced at various energies of the incident neutrons, and anomalous behaviour for certain elements is found. N. M. B.

Absorption of slow neutrons in dysprosium and cadmium. J. J. GUREVITSCH and M. G. MESCHTSCHERJAKOV (Physikal. Z. Sovietunion, 1938, **13**, 151—169).—The absorption of Dy is almost entirely confined to the *C* neutrons, but a weak absorption also occurs at approx. 0·6 e.v. Absorption is mainly due to ^{164}Dy and leads to the formation of radio-Dy. The absorption coeffs. in Cd of *C* neutrons and of neutrons of 0·6 e.v. energy are 15·8 cm.^{2} per g. and 0·54 cm.^{2} per g., respectively. The position and width of the Cd resonance band are calc. to be 0·17 e.v. and 0·18 e.v., respectively. O. D. S.

Slow neutrons and nuclear energy levels. E. FERMI (Nuovo Cim., 1938, **15**, 41—42).—A summary of work on the determination of nuclear energy levels by means of absorption measurements of slow neutrons. O. J. W.

Neutrons by α-particle bombardment of light elements. C. S. COPELAND and S. C. LIND (J. Physical Chem., 1938, **42**, 567—574).—The neutron emission under bombardment by α-particles from Rn has been studied for all elements from Li to Ca by measurement of the radioactivity induced in I. Definite neutron emission was observed from Li, Be, B, N, F, Na, Mg, Al, P, and Cl compounds, but the

emission from C, SiO_2, S, K_2CO_3, $CaCO_3$, and Zn is <0·5% of that of Be. J. W. S.

Collisions of deuterons with heavy nuclei. I. E. LIFSCHITZ (Physikal. Z. Sovietunion, 1938, **13**, 224—243).—Mathematical. Collisions leading to the disintegration of the deuteron and capture by the nucleus of a neutron are discussed. The reaction cross-section as a function of deuteron energy, and the energy distribution of the outgoing particles, are calc. O. D. S.

Fine structure of the yield-curve of the transmutation of aluminium. A. SZALAY (Nature, 1938, **141**, 972—973).—A graph showing the integral yield of positrons from ^{30}P, obtained by bombardment of Al with α-rays from a Po source, as a function of the average range of exciting α-particles is reproduced. At each α-particle range where levels are observed for proton emission, resonance levels for the neutron emission exist. Unlike the proton yields, the neutron yield for each of these four levels is different. The ratio proton yield : neutron yield decreases with an increase in energy of the exciting α-particle. L. S. T.

Artificial radioactivity. III. K. DIEBNER and E. GRASSMANN (Physikal. Z., 1938, **39**, 469—501; cf. A., 1936, 773; 1937, I, 389).—A comprehensive review of results of the investigation of artificial radioactivity up to March, 1938. A. J. M.

Measurements on slow neutrons. E. SEGRÈ (Ric. Sci. Progr. tech., 1936, [ii], **7**, 389—390; Chem. Zentr., 1936, ii, 1836—1837).—The 44-sec. and the 4·2-min. activities of Rh are affected in the same way by the insertion of Cd. With Cu, the 5-min. activity is reduced in the ratio 5 : 1 and the 10-hr. activity falls practically to zero. For Ag and Rh, the reflexion coeff. for group *C* neutrons within a H_3BO_3 solution decreases with an increase in $[H_3BO_3]$. L. S. T.

Disintegration of boron by slow neutrons. J. C. BOWER, E. BRETSCHER, and C. W. GILBERT (Proc. Camb. Phil. Soc., 1938, **34**, 290—295).—The disintegration of B by slow neutrons according to $^{10}_5B + ^1_0n = ^7_3Li + ^4_2He$ produces Li and He particles with ranges 4·3±0·2 mm. and 7·0±0·3 mm. in standard air. The Li particle is usually found in an excited state with an excitation energy of 0·5 or 0·8 M.e.v. F. J. L.

Further experiments on the slow neutrons transmitted by cadmium: influence of the temperature of the slowing-down medium. C. H. WESTCOTT and L. SOSNOWSKI (Proc. Camb. Phil. Soc., 1938, **34**, 272—281).—The neutrons of group *B* have energies low enough to be affected by temp. It is suggested that Cd transmits neutrons of energies down to 0·2 e.v., and that group *B* is inhomogeneous. F. J. L.

Excitation functions of the (α, *n*) transitions of nitrogen, aluminium, and argon. E. FÜNFER (Ann. Physik, 1938, [v], **32**, 313—335).—The $^{14}_7N\ (\alpha,n)\ ^{17}_9F$, $^{27}_{13}Al\ (\alpha,n)\ ^{30}_{15}P$, and the $^{40}_{18}A\ (\alpha,n)\ ^{43}_{20}Ca$ transitions were studied by passage of α-particles successively through the gas, paraffin, and B into symmetrically disposed counter tubes. The paraffin serves to slow down the neutrons to thermal velocities and the B reconverts them into α-particles. The excitation curves obtained are discussed in relation to the resonance levels of the mol. examined. L. G. G.

Long-lived radio-cobalt isotopes. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], **53**, 847—848; cf. A., 1937, I, 490).—Activity and absorption curves of chemically separated radioactive Co obtained from neutron and deuteron bombardment of Co_2O_3 are given and discussed. The initial rate of decay indicates a 2-year period, but subsequently becomes of the order 10 years. The activity attributed by Perrier (cf. A., 1938, I, 111) to Co formed from Cu on the cyclotron deflector plate is probably due to the two Co periods produced from the deuteron bombardment of Fe. N. M. B.

Artificial transition processes by irradiation of thorium with neutrons. Appearance of isomeric series through expulsion of α-rays. L. MEITNER, F. STRASSMANN, and O. HAHN (Z. Physik, 1938, **109**, 538—552).—Four transition processes are shown to occur by bombardment of Th with slow and fast neutrons, one of which is initiated by direct neutron capture and the other three by neutron capture and α-particle expulsion. Half-life periods of the components of the series are given. L. G. G.

Nature of the radioelement of period 3·5 hours formed in uranium irradiated by neutrons. (MME.) I. CURIE and P. SAVITCH (Compt. rend., 1938, **206**, 1643—1644; cf. A., 1938, I, 291).—The radiation of the element ($R_{3\cdot5h}$) consists of electrons with a small proportion of positrons, possibly due to internal materialisation of γ-rays. The chemical properties resemble those of the Ce earths and Ac; $R_{3\cdot5h}$ can, however, be separated from Ac by fractional pptn. of the oxalates in HNO_3. It is concluded that $R_{3\cdot5h}$ is a new trans-uranian element. A. J. E. W.

γ-Radiation from proton bombardment of carbon. M. E. ROSE (Physical Rev., 1938, [ii], **53**, 845).—Evidence is given that the 560 k.e.v. resonance radiation observed in the capture of protons by C and assigned to the capture of protons by ^{13}C with formation of ^{14}N is not monochromatic. The absorption curve and the reaction when C is bombarded by deuterons point to the existence of three γ-rays, one of 8·2 M.e.v., and two of about 4 M.e.v., the absorption curve being a superposition of the three individual curves weighted according to the intensities of the γ-rays. N. M. B.

Neutron–electron interaction proposed by Kikuchi. G. T. SEABORG and D. C. GRAHAME (Nature, 1938, **141**, 1053).—The emission of γ-rays in the D–D reaction (A., 1938, I, 169) offers a simpler and more satisfactory explanation of the phenomena observed by Kikuchi *et al.* (A., 1937, I, 4). L. S. T.

Pressure-dependence of ionisation due to ultra-radiation and γ-radiation. J. CLAY (Z. Physik, 1938, **109**, 477—484).—The column-ionisation formula of Jaffé, as modified by Zanstra, is verified by measurements of the ionisation produced by cosmic and γ-rays in air, CO_2, and A at pressures up to 150 atm. The relationship between degree of satur-

ation and field strength is discussed. It is found that γ-ray ionisation is approx. $\propto$ (at. no.)^2 and cosmic ray ionisation approx. $\propto$ density. L. G. G.

Specific ionisation and mass of cosmic-ray particles. D. R. CORSON and R. B. BRODE (Physical Rev., 1938, [ii], **53**, 773—777).—The sp. ionisation of 120 cosmic-ray tracks for $H\rho$ 10^3—2×10^5, measured by counting droplets in photographs of delayed expansion cloud-chamber tracks, is in good agreement with theory. Results are applied to the calculation of the mass of heavily ionising cosmic-ray particles. The masses of all heavy particles are in approx. agreement with a unique mass of $(200 \pm 50)m_0$. N. M. B.

Influence of the solar magnetic field on cosmic rays. P. S. EPSTEIN (Physical Rev., 1938, [ii], **53**, 862—866).—The effect of the solar field on cosmic-ray intensities at different localities on the earth, and the diurnal and annual variations of the solar effect, are calc. and discussed. N. M. B.

Nature and origin of the incoming cosmic rays. I. S. BOWEN, R. A. MILLIKAN, and H. V. NEHER (Physical Rev., 1938, [ii], **53**, 855—861; cf. A., 1938, I, 171).—Quant. data on the smallness of the fraction of the total incoming energy that can be assigned to photons show that the cosmic rays cannot have come through an appreciable amount of matter in comparison with an atm. before entering the solar system. The energies of the incoming rays correspond roughly with the annihilation energies of the atoms of the most abundant elements. N. M. B.

Penetrating component of the cosmic radiation. J. BARNÓTHY and M. FORRÓ (Physical Rev., 1938, [ii], **53**, 848).—Curves of the intensity variation of cosmic ray showers from 4000 m. above sea level to 1000 m. H_2O equiv. depth show bends at about 10—20 m. and at 250 m. H_2O equiv., indicating that from these depths onwards the showers are produced mainly by heavy electrons and by neutrinos, respectively (cf. Wilson, A., 1938, 1, 225). N. M. B.

Nature of the penetrating cosmic rays. V. C. WILSON (Physical Rev., 1938, [ii], **53**, 908—909; cf. A., 1938, 1, 225).—Investigations described support the view that the type of penetrating cosmic ray with a max. range of 250 m. H_2O equiv. consists of heavy electrons, and that the one with a much greater range consists of neutrinos. N. M. B.

Actual experimental knowledge about cosmic radiation. B. ROSSI (Nuovo Cim., 1938, **15**, 43—65). —A summary. O. J. W.

Secondary effects of the hard and soft components of cosmic rays. B. TRUMPY (Nature, 1938, **141**, 909—910).—A statistical investigation of the no. of secondary cosmic rays produced in an Fe-screened and an unscreened automatic cloud chamber, divided into sections by four parallel Pb plates, 3 cm. thick, shows that the soft components of the cosmic rays amount to approx. 27% of the total radiation at the earth's surface, and that the hard components cannot be electrons. L. S. T.

Mathematical formalism of the theory of showers. D. IVANENKO and A. SOKOLOV (Physical Rev., 1938, [ii], **53**, 910). N. M. B.

Hoffmann showers and the penetrating component of ultra-radiation. H. EULER (Naturwiss., 1938, **26**, 382—383).—Theoretical. The consts. of the electron-spectra concerned in cascade showers are calc. A. J. M.

High-altitude cosmic radiation measurements near the magnetic axis-pole. H. CARMICHAEL and E. G. DYMOND (Nature, 1938, **141**, 910—911).—The radiation intensity at the pole is approx. equal to that at latitude 50°. Cosmic rays of energy $<$ approx. 3×10^9 e.v. either do not exist in space or are prevented from reaching the earth by an agency other than the terrestrial magnetic field. L. S. T.

Formation of free sodium atoms in the upper atmosphere. R. BERNARD (Compt. rend., 1938, **206**, 1669—1672; cf. A., 1938, 1, 285).—The following mechanism for the formation of Na atoms is discussed: N_2 $(A^3\Sigma) + H_2O \rightarrow N_2$ $(X^1\Sigma) + OH + H$; $H + NaCl \rightarrow HCl + Na$. The NaCl is assumed to be of oceanic origin. This mechanism accounts for the occurrence of OH bands in the sky spectrum. A. J. E. W.

Elements 43 and 61. H. JENSEN (Naturwiss., 1938, **26**, 381).—The possibility of the existence of elements of at. no. 43 and 61 is discussed from the viewpoint of Mattauch's rule that of two isobares which differ by 1 in nuclear charge, one must be unstable. Since ^{60}Nd and ^{62}Sm are both abundant and stable, the rule predicts the non-existence of a stable isotope of at. no. 61. This is also true for the isotope of at. no. 43. The possibility of the existence of β-active isotopes with these mass nos. and with comparatively long life cannot, however, be excluded, although it is very improbable. It might also be possible that one of the isotopes adjacent to element 43 or 61 is β-active with a very long life. Anomalies in the curve of energy surface of the nucleus as a function of at. no. also support the view that isotopes of 43 and 61 cannot exist. A. J. M.

Nuclear structure of radioactive substances. U. C. BARDHAN (Phil. Mag., 1938, [vii], **25**, 1033—1041).—Mathematical. T. H. G.

Tracks of stellar evolution. G. GAMOW (Physical Rev., 1938, [ii], **53**, 907—908; cf. A., 1938, 1, 291). —The relation between the features of the star distribution along the main sequence and the proton-proton reaction is examined. N. M. B.

Reversibility of the equations of classical dynamics. E. A. MILNE and G. J. WHITROW (Nature, 1938, **141**, 905—906).—Theoretical. L. S. T.

Theory of exchange forces. D. IVANENKO (Physikal. Z. Sovietunion, 1938, **13**, 141—150).—Mathematical. Some special cases of exchange action transformations are discussed with reference to the theory of nuclear β-ray decomp. O. D. S.

Binding energy of the atomic nucleus and α-decay. V. TSCHERDINZEV (Physikal. Z. Sovietunion, 1938, **13**, 170—180).—Theoretical. Using the liquid drop model of the at. nucleus, a relation is obtained between the at. wt. and the binding energy in the nucleus, agreeing with experiment. A derived relation between α-decay energy and at. wt. has a max.

in the region of natural emitters and leads to a relation between the life-time of α-emitters and their at. wts. agreeing with experiment. O. D. S.

Atomic constants. E. DE MAYOLA (Bol. Soc. Quim. Peru, 1938, **4**, 25—50).—A survey of the literature. F. R. G.

Rotation of the atomic nucleus. E. TELLER and J. A. WHEELER (Physical Rev., 1938, [ii], **53**, 778—789).—The spacing of the levels in the fine structure of α- and β-ray processes and the existence of metastable nuclear states contradict the existence of low-lying levels corresponding with the rotation of the nucleus as a whole. The exchange of the nuclear constituents effected through rotation, and the absence of rigid binding in the nucleus, will in some cases forbid and in other cases perturb the lowest levels and cause the first state of excitation to lie considerably higher. Simple models illustrating these effects are discussed. The estimated position of the lowest excited level for heavy nuclei varies inversely with the mass. N. M. B.

Energy content of the heavy nuclei. A. J. DEMPSTER (Physical Rev., 1938, [ii], **53**, 869—874).—A packing fraction curve is drawn from known at. masses (cf. A., 1938, I, 111) and from new vals. for Sn, La, and Nd, and in agreement with differences in packing fractions for 25 pairs previously reported. The curve has the general shape of Aston's curve, but has a higher min. and is higher for the heavy elements. For those below Pb the curve is much less steep than above, giving an energy content to these elements such that α-ray emission is impossible. The mass differences of Pb, Th, and U in relation to α- and β-ray emission are discussed. The effect of the packing fractions on the computed at. wt. of Lu, Nd, Th, and U is examined, and the masses of isotopes of Au, Sn, Nd, and La are compared. N. M. B.

Excited states of the ^{3}H and ^{4}He nuclei. S. S. SHARE (Physical Rev., 1938, [ii], **53**, 875—879).—Mathematical. A discussion of investigations made with trial wave functions. N. M. B.

Magnetic moment of ^{7}Li in the α-particle model. H. A. BETHE (Physical Rev., 1938, [ii], **53**, 842).—The discrepancy between the difference vals. of the ^{7}Li and ^{1}H moments, as found by Rabi's high-precision method (cf. A., 1938, I, 293) and from theories based on the one-particle Hartree model, is examined and an explanation is proposed. N. M. B.

Nuclear magnetic moment of ^{7}Li by perturbation theory. D. R. INGLIS (Physical Rev., 1938, [ii], **53**, 880—888).—Mathematical. First-order calculations show that the orbital part of the magnetic moment is 0·26—0·30 μ_N; the second-order modification is very small (0·01 μ_N from the doubly excited states). N. M. B.

Saturation of nuclear forces. C. CRITCHFIELD and E. TELLER (Physical Rev., 1938, [iii], **53**, 812—818).—Mathematical. The forces between heavy particles (neutrons and protons) are investigated on the assumption that they emit electron–positron pairs and that the interaction of the heavy particles with the field of light particles is large compared with the kinetic energy of the light particles. It is shown that potentials result which are of the same order of magnitude as the kinetic energy of the light particles. When many heavy particles interact the total potential energy ∝ the no. of particles. N. M. B.

Self-consistent field for molecular hydrogen. C. A. COULSON (Proc. Camb. Phil. Soc., 1938, **34**, 204—212).—An analytical expansion of the wave function of mol. H_2 is obtained, using the method of the self-consistent field. F. J. L.

Potential barrier in nuclear mechanics and nuclear dimensions of heavy radioactive elements. T. KAHAN (Compt. rend., 1938, **206**, 1289—1291).—Theoretical. A. J. E. W.

Wave function of the He ground state. J. SOLOK (Physikal. Z. Sovietunion, 1937, **12**, 120—122).—Theoretical. J. A. D.

Existence of a neutrino. H. R. CRANE and J. HALPERN (Physical Rev., 1938, [ii], **53**, 789—794).—In a new method for determining the energy of recoil of the nucleus in the individual β-disintegration process the cloud chamber contains ^{38}Cl, and the clearing field is removed long enough before the expansion to allow the ions to spread out so that the resulting droplets can be seen individually. A cluster of droplets, believed to be produced by the recoil nucleus, appears at the beginning of the track, and the kinetic energy of the nucleus, estimated from the no. of droplets, is compared with that calc. from the observed curvature of the β-ray track. The laws of momentum and of energy indicate that a third particle participates in the disintegration. N. M. B.

Connexion between electromagnetic and neutrino fields. (A) A. SOKOLOV. (B) M. H. L. PRYCE (Nature, 1938, **141**, 976).—Theoretical. L. S. T.

Representation of the plane monochromatic wave solutions of the equation of Dirac. G. PETIAU (J. Phys. Radium, 1938, [vii], **9**, 171—177).—Mathematical. W. R. A.

Temperature variation of electron spin paramagnetism: numerical results. E. C. STONER (Proc. Leeds Phil. Soc., 1938, **3**, 403—415; cf. A., 1936, 266, 785). F. J. L.

Triplet–triplet perturbations in band spectra I. KOVÁCS (Z. Physik, 1938, **109**, 387—392).—It is shown that a suitable transformation of the determinantal product, involving a simplification of the 9-termed secular determinant of the $^3\Sigma \leftrightarrow 3\pi$ perturbation, leads to an explicit calculation of the perturbed term. L. G. G.

Singlet–triplet perturbations in band spectra. A. BUDÓ and I. KOVÁCS (Z. Physik, 1938, **109**, 393—402; cf. preceding abstract).—Modifications of the Hamiltonian operator in the formulation of singlet–triplet perturbations are derived. A $^3\Sigma$ perturbation of the $A\,^1\Pi$ CO term is given as an example. L. G. G.

Absorption spectrum of fluorene in various states of aggregation. B. TWAROWSKA (Z. Physik, 1938, **109**, 403—412).—Absorption spectra of fluorene as vapour, solid, and solute (in *o*-xylene) were photo-

graphed in the visual range at room temp. and also, in the case of the solid and solute, at −180°. At −180°, resolution of the diffuse band obtained at room temp. into a series of narrow bands occurs, this being most noticeable in the crystal. Peculiarities in the fluorescence of fluorene in different states are discussed. L. G. G.

New anomalous effect in the short-wave end of the solar spectrum. I. S. Rodionov, E. Pavlova, and N. Stoopnikov (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 55—57).—Curves for the intensity of the short λλ of the solar spectrum as a function of the length of a ray path through a layer of O_3 show anomalies for oblique morning and evening sunlight. It is suggested that the effect is due to anomalous refraction of short λλ in the O_3 layer. N. M. B.

Umkehr effect. II. S. Rodionov and E. Pavlova (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 59—60).—At great zenith distances of the sun, the scattered zenith light intensity ratio of two close λλ in the region 3300—3100 A. passes through a min. (Umkehr effect; cf. Götz *et al.*, A., 1934, 1087). New measurements are plotted and discussed; a comparison is made with the anomalous effect previously described (cf. preceding abstract). N. M. B.

Absorption coefficients of ozone in the region of the Chappuis bands. (Mme.) A. Vassy (Compt. rend., 1938, **206**, 1638—1639; cf. A., 1938, I, 58).—Vals. of the absorption coeff. at 18° for λλ between 4380 and 7585 A. are tabulated. A. J. E. W.

Spectrum of the nuclei of comets and the bands of the CH molecule. J. Dufay (Compt. rend., 1938, **206**, 1550—1553).—The group of lines at ~4300 A., observed in the spectra of five comets, corresponds with the $0 \rightarrow 0$ and $1 \rightarrow 1$ bands of the $A \rightarrow X$ system of CH, except a line at 4319 A. due to N_2 (A., 1937, I, 207). The group at ~4050 A. may also be due to a CH transition involving a hitherto unknown level. A. J. E. W.

Distribution of the rotation state in an elementary process of molecule formation (not Boltzmann distribution) and alteration of the relative probability of transition. H. Schüler and H. Gollnow (Z. Physik, 1938, **109**, 432; cf. A., 1938, I, 341).—An addendum. H. C. G.

Absorption spectrum of cæsium hydride. G. M. Almy and M. Rassweiler (Physical Rev., 1938, [ii], **53**, 890—894).—A $^1\Sigma \rightarrow {}^1\Sigma$ mol. spectrum of CsH photographed in absorption in the range 4550—6250 A. consists of 31 two-branch bands. The calc. rotational and vibrational consts. for two electronic states show the anomaly characteristic of the alkali hydrides. The heats of dissociation are 1·10 and 1·96 v. for the excited and ground states. Potential energy curves are given, and show that Mulliken's explanation of the anomaly (cf. A., 1937, I, 66) covers the case of CsH. N. M. B.

Band spectra of SrCl and SrH. K. R. More and S. D. Cornell (Physical Rev., 1938, [ii], **53**, 806—811).—The spectra of SrCl and SrH are observed in absorption (cf. A., 1932, 439; 1935, 1443; 1936, 267, 1317). Parker's SrCl analysis is confirmed (cf. A., 1935, 562). Measurement of the relative intensities of corresponding bands of the electronic doublet $^2\Pi \rightarrow {}^2\Sigma$ indicates that $^2\Sigma$ is the ground state. Consts. are evaluated from rotational and vibrational analyses, and perturbations are discussed. N. M. B.

Mechanism of formation of mercury hydride and mercury deuteride. Optical excitation of cadmium deuteride. L. O. Olsen (J. Chem. Physics, 1938, **6**, 307—310).—A mixture of Hg vapour, H_2, and N_2 was illuminated by a Hg and H (or He) discharge. The spectrum of the excited radiation revealed the presence of HgH, but no resonance excitation of HgH was observed. This indicates that the HgH mols. are formed in an excited state and dissociate after emission. The formation process, $Hg\,6^3P_1 + H \rightarrow HgH\,{}^2\Pi_{1/2,\ 3/2} + \Delta$ (Δ is an energy parameter), is supported by experimental evidence. Similar results were obtained for HgD. Resonance excitation of CdH (or CdD) was confirmed when a mixture of Cd and H_2 (or D_2) was illuminated with a Cd and H (or D) discharge. W. R. A.

Ultra-violet radiation of crystals under the action of γ-rays. E. K. Zavadovskaja (Physikal. Z. Sovietunion, 1938, **13**, 244—246).—NaCl, SiO_2, and $CaCO_3$ crystals emit in the ultra-violet region under the action of γ-rays from a Ra source. O. D. S.

Effect of irradiation on the transmission of lithium fluoride. E. G. Schneider (J. Opt. Soc. Amer., 1937, **27**, 72—74).—The transmission of LiF in the visible and ultra-violet is reduced by exposure to intense ultra-violet radiation, electron bombardment, or contact with a low-pressure electrical discharge. Exposure for 75 hr. to the light of a H discharge tube caused only about 5% max. transmission decrease, but in the other two cases strong absorption bands with max. at 5200, 3100, and 2500 A. and a gradually increasing absorption below 1800 A. appear after a few min. exposure. Practical applications are discussed. N. M. B.

Band spectra of alkaline-earth iodides. P. Mesnage (Compt. rend., 1938, **206**, 1634—1635).—An analysis has been made of emission band systems of CaI_2 (4180—4380 A.), SrI_2 (4250—4480 A.), and BaI_2 (5360—5610 A.), due in each case to the diat. mols. MI. CaI_2 gives a single band system, SrI_2 two distinct systems, and BaI_2 certain sequences of a doublet system. A. J. E. W.

Spectra of absorption by reflexion of solid substances in the visible and ultra-violet. M. Billy and A. Berton (Compt. rend., 1938, **206**, 1631—1634).—The spectrum of light reflected from a rough solid surface consists of a continuum due to pure reflexion, on which absorption bands due to internal reflexion and absorption in the surface particles are superposed. These bands are characteristic of the chemical composition, cryst. structure, or degree of polymerisation of the substance examined. A no. of typical spectra, including those of aq. $H_2C_2O_4$, are reproduced and discussed. A. J. E. W.

Absorption bands and electron transitions in coloured fluorites. K. Przibram (Nature, 1938,

141, 970; cf. A., 1937, I, 220).—The different colours of fluorites can be explained by the varying intensities of the different absorption max. $Eu^{\cdot\cdot}$ alone gives a light yellow colour (Derbyshire); $Sm^{\cdot\cdot}$, a deeper yellowish-brown; the bivalent rare earths together with the Ca max., the green colours (Weardale); and predominance of the Ca max., the blue and violet colours. Various colour changes brought about by light or heat are attributed to the transfer of electrons between the bivalent rare-earth ions and the $Ca^{\cdot\cdot}$ ions. L. S. T.

Absorption spectra and chemical processes in discharges. N. Prileshaeva and G. Neter (J. Phys. Chem. Russ., 1938, **11**, 254—261).—An attempt is made to identify the reaction products by observing the absorption spectra of gas mixtures before, during, and after the discharge. Thus, NH_2Ph is shown to be formed from C_6H_6 and NH_3, C_6H_6 from $PhNO_2$ and H_2, PhOH from C_6H_6 and H_2O, PhCHO from C_6H_6 and CO, and C_6H_6 from PhCHO. Fluorescence spectra reveal the reaction $C_6H_6 + CH_4 \rightleftharpoons PhMe + H_2$. No formation of NH_2Ph from PhOH and NH_3, or of C_6H_6 from PhOH and H_2, can be detected. J. J. B.

Absorption spectra of co-ordination compounds. I. R. Tsuchida (Bull. Chem. Soc. Japan, 1938, **13**, 388—400).—The origins of absorption bands of co-ordination compounds are discussed. The first band is more or less additive, and is attributed to electron transitions in the unsaturated transition shell of the central ion, and is absent if the central ion is not a transition element. The second band is attributed to the co-ordination electrons, and is therefore the most general characteristic of these compounds. The third band is due to one or more pairs of negative radicals co-ordinated in *trans* positions, and is independent of the kind and valency of the central ion, the sort of radical provided it is negative, the charge of the complex radical, or the configuration so long as the *trans* pairing condition is fulfilled. C. R. H.

Absorption spectra. II. Spectra of toluidine, benzidine, and their hydrochlorides. (Mlle.) C. de Borst, P. M. Heertjes, and H. I. Waterman (Bull. Soc. chim., 1938, [v], **5**, 888—895; cf. A., 1936, 661, 1443).—The absorption spectra of *p*-toluidine, benzidine, and their hydrochlorides have been measured over the range λ 2200—3500 in H_2O, and those of PhMe and of Ph_2 in C_6H_{14}. The spectra of the hydrochlorides differ considerably from those of the amines, being displaced towards shorter λ and approximating closely to those of the corresponding hydrocarbons. From the results it is deduced that the dissociation const. of *p*-$C_6H_4Me{\cdot}NH_3Cl$ is $2{\cdot}03 \times 10^{-5}$ at 18°. J. W. S.

Absorption spectra of para-substituted derivatives of azobenzene. The Dilthey–Wizinger chromophor theory. A. Pongratz, G. Markgraf, and E. Mayer-Pitsch (Ber., 1938, **71**, [*B*], 1287—1296).—The absorption spectra of azobenzene (I) and the following derivatives of it have been measured: *p*-hydroxy-, m.p. 155—156° (corr.); *p*-amino-, m.p. 124·5—125·5° (corr.); *p*-acetamido-, m.p. 144—145° (corr.); *p*-dimethylamino-, m.p. 118—118·5° (corr.); *p*-nitro-, m.p. 134·5—135° (corr.); *p*-nitro-*p'*-hydroxy-, m.p. 219·0—219·5° (corr.); *p*-amino-*p'*-hydroxy-, m.p. 188—189° (corr.); *p*-acetamido-*p'*-hydroxy-, m.p. 202·5—203° (corr.); *p*-nitro-*p'*-dimethylamino-, m.p. 234·5—235·0° (corr.); *p*-amino-*p'*-dimethylamino-, m.p. 191·5—192° (corr.); *p*-acetamido-*p'*-dimethylamino-, m.p. 226—227° (corr.); *p*-azobenzenetrimethylammonium iodide (II), m.p. 185·5—186° (corr.), and p-*acetamidoazobenzene*-p'-*trimethylammonium iodide* (III), m.p. 197° (corr.). The displacement of the band max. towards lower frequencies increases regularly in the sequence H, NMe_3I, NO_2, OH, and NHAc, NH_2, NMe_2 as a consequence of the increasingly marked electric contrast at the N atoms of the N_2 group. With the exception of NO_2 the groups are to be regarded as relatively positive. For the same reason invariable displacements of the main bands are observed when one substituent remains unaltered and the second, in the other C_6H_6 nucleus, is altered: when, for example, the groups H, NHAc, NH_2, NO_2 are successively brought into contraposition to NMe_2. The absorption curves of (II) and (III) harmonise with Wizinger's conception. (I) reacts with MeI giving crystals of unelucidated nature. H. W.

Halochromy phenomena in perylene, its quinones and substitution products. M. Pestemer, A. J. K. Schmidt, L. Schmidt-Wiligut, and F. Manchen (Monatsh., 1938, **71**, 432—439).—Absorption curves in the visible and ultra-violet regions are given for perylene, 3 : 4 : 9 : 10-tetrabenzoyloxy-, 1 : 12-dihydroxy-3 : 9-dibenzoyl-, 3 : 9-dibenzoyl-, and 3 : 9-diphenyldivinyl-perylene, perylene-3 : 9-, perylene-1 : 12-, 3 : 9-dibenzoylperylene-1 : 12-, 2 : 11-dihydroxyperylene-3 : 10-, and 2 : 11-dibenzoyloxyperylene-3 : 10-quinone in inert solvents (heptane, decalin, C_6H_6) and in H_2SO_4. In the inert solvents characteristic differences between the benzenoid derivatives and the quinones are noted. In H_2SO_4 the curves for perylene and its benzenoid derivatives resemble those for the 3 : 10-quinones, indicating the formation of halochromic additive products by attack of H_2SO_4 at the 3 : 10-positions of perylene. E. S. H.

Absorption spectrum of heavy water in the near infra-red. G. Champetier, R. Freymann, and Y. Ta (Bull. Soc. chim., 1938, [v], **5**, 929—931).—The existence of intense bands at 2·0 and 1·33 μ. and weak bands at 1·70 and 1·19 μ. is confirmed. A new band has been observed at 1·016 μ. Other bands previously reported are attributed to traces of H_2O. The absorption of D_2O is much weaker than that of H_2O. J. W. S.

Change in absorption of water at 4·7 μ. due to solutions. E. K. Plyler and E. S. Barr (J. Chem. Physics, 1938, **6**, 316—318).—Aq. solutions of K and NH_4 halides have been examined in the region 3·0—5·4 μ. and NaBr in the region 4·5—6·5 μ. The effects of changes in concn. and in positive ion are discussed. Fluorides change the position of the H_2O band from 4·72 to shorter λλ, whilst chlorides, bromides, and iodides alter it to longer λλ. This effect may be due to changes in hindered rotation produced

by binding forces between the ions and the H_2O mols. W. R. A.

Structure of the methane molecule. H. A. JAHN and W. H. J. CHILDS (Nature, 1938, **141**, 916).—The complex rotational fine structure of the 1306 cm.$^{-1}$ fundamental vibrational band of CH_4 is due to a Coriolis coupling between the rotational levels of this threefold degenerate mode of vibration ν_4 and the rotational levels of the infra-red inactive twofold degenerate vibration ν_2 at 1536 cm.$^{-1}$ A theoretical spectrum that agrees well with that observed has been derived. Similar perturbations may be expected in the spectra of all polyat. mols. possessing a threefold or higher axis of symmetry. L. S. T.

Infra-red absorption bands in the spectrum of deuteroformaldehyde. E. S. EBERS and H. H. NIELSEN (J. Chem. Physics, 1938, **6**, 311—315; cf. A., 1937, I, 112, 598).—By irradiation from a quartz Hg arc D_2 and CO combine photochemically to give CD_2O. The infra-red absorption spectrum of CD_2O between 2·0 and 13·0 μ. shows seven bands. From these and existing data for CH_2O the six fundamental frequencies have been assigned, utilising the product ratio connecting the frequencies of isotopic analogues. Valency force consts. for both mols. have been computed. W. R. A.

Higher harmonics of the C–H vibration in the near infra-red. A. CARRELLI and P. TULIPANO (Nuovo Cim., 1938, **15**, 1—4).—Three absorption bands of $CHBr_3$ and two of C_6H_6 have been observed in the region 5000—15,000 cm.$^{-1}$ The frequencies of the max. of these bands show that they are higher harmonics of the fundamental C–H frequency. Some regularities in these spectra are pointed out. O. J. W.

Infra-red absorption spectra of trisubstituted benzene derivatives. Symmetry of benzene. J. LECOMTE (Compt. rend., 1938, **206**, 1568—1570; cf. A., 1938, I, 174).—$\nu\nu$ of the principal absorption regions of trisubstituted C_6H_6 derivatives, deduced from measurements on about 70 compounds in the range 500—1350 cm.$^{-1}$, are given. The results, which confirm previous conclusions as to the six-fold symmetry of C_6H_6, are discussed in relation to possible modes of vibration of the mols. A. J. E. W.

Spectroscopy of the far infra-red. H. M. RANDALL (Rev. Mod. Physics, 1938, **10**, 72—85).—A lecture, mainly devoted to apparatus and technique. E. S. H.

Raman spectra and structure of ozonides. Raman spectra of the ozonides of anethole, estragole, *p*-methoxyphenylacetaldehyde, and ψ-estragole. E. BRINER, S. DE NEMITZ, and E. PERROTTET (Helv. Chim. Acta, 1938, **21**, 762—766).—Addition of O_3 to aldehydes causes the appearance of frequencies in the region 1660—1884 cm.$^{-1}$ also observed in the Raman spectra of org. anhydrides and peroxides. This is in accord with chemical behaviour, since ozonides combine the properties of anhydrides and peroxides. The frequency of the ethylenic linking decreases in the order anethole > estragole > ψ-estragole, in accord with previous observations. J W. S.

Raman spectrum of ethyl alcohol–water mixtures. F. CENNAMO (Nuovo Cim., 1938, **15**, 10—13).—With increase of [EtOH] the intensity of the band at 3620 cm.$^{-1}$, which is attributed by various authors to simple H_2O mols., decreases. O. J. W.

Raman effect in liquid acetylene. G. GLOCKLER and M. M. RENFREW (J. Chem. Physics, 1938, **6**, 340).—No rotation lines accompanying the strong Raman frequencies of liquid C_2H_2 at −75° could be detected after an exposure of 16 hr. (cf. A., 1936, 269). A new displacement of 1259 cm.$^{-1}$ is probably the same as the shift of 1233 cm.$^{-1}$ reported for the gas by Bhagavantam and Rao (*ibid.*, 546, 663), and is possibly an overtone of the deformation frequency at 630 cm.$^{-1}$ Accompanying the 1961 cm.$^{-1}$ line is a weak satellite at 1934 cm.$^{-1}$ which is attributed to $^{13}CH:^{12}CH$. Theoretically this isotopic frequency is 1929 cm.$^{-1}$ No isotopic companion was found for the 3341 cm.$^{-1}$ frequency. The frequencies at 560 cm.$^{-1}$ and 631 cm.$^{-1}$ are also discussed. W. R. A.

Raman spectra of deuteroethylenes. M. DE HEMPTINNE, J. JUNGERS, and J. M. DELFOSSE (J. Chem. Physics, 1938, **6**, 319—324; cf. A., 1937, I, 549).—C_2H_4 was deuterated by two methods. In one, progressive deuteration was effected by the exchange reaction between C_2H_4 and D_2O in the presence of a catalyst. In the other, C_2H_3D (*a*), $(CHD)_2$ (*cis* and *trans*) (*b*), and C_2D_4 (*c*) were prepared in a pure state by reduction of the corresponding dibromide with Zn in H_2O by the following reactions: (*a*) $CH_2{:}CHBr + DBr \rightarrow CH_2Br{\cdot}CHDBr \rightarrow CH_2{:}CHD$; (*b*) $CD{:}CD + 2HBr \rightarrow CHDBr{\cdot}CHDBr \rightarrow CHD{:}CHD$; (*c*) $CD{:}CD + 2DBr \rightarrow CD_2Br{\cdot}CD_2Br \rightarrow CD_2{:}CD_2$. Raman spectra of liquefied C_2H_4, C_2H_3D, *cis*- and *trans*-$(CHD)_2$, $CH_2{:}CD_2$, C_2HD_3, and C_2D_4 are recorded. Assignments of normal modes of vibration are made, and the effect of isotopic substitution on ν is discussed. The product ratio of corresponding $\nu\nu$ of the two isotopic species is applied and the anharmonicity corrections are deduced. W. R. A.

Raman effect. LXXXIV. Methyl derivatives. J. WAGNER (Z. physikal. Chem., 1938, **B**, **40**, 36—50).—Measurements on the Raman spectra of MeCl, MeBr, MeI, MeSH, and MeOH are recorded. The variation of the 3000, 2950, and 1430 cm.$^{-1}$ frequencies of the Me group in MeX with change in the nature of the substituent X (= Cl, Br, I, CH_3, OH, SH, NH_2) is discussed. The following force consts. are calc.: C–H 4·96, C–Cl 3·34, C–Br 2·76, C–I 2·26, C–C 4·95, C–N 5·61, C–O 5·73, C–S 3·44, all × 10^5, dyne/cm. H. J. E.

Raman effect. LXXXV. Boric acid and derivatives. L. KAHOVEC (Z. physikal. Chem., 1938, **B**, **40**, 135—145).—Data are recorded for $B(OH)_3$, for esters of the type $B(OR)_3$, where R = Me, Et, Pr$^{\alpha}$, Pr$^{\beta}$, Bu$^{\alpha}$, or $C_5H_{11}{}^{\beta}$, and for $CH(OMe)_3$. Ananthakrishnan's data for the Me and Et esters are confirmed (cf. A., 1936, 1179). The restoring force per unit displacement for the OH group in cryst. H_3BO_3, derived from the frequency 3166 cm.$^{-1}$, is 5·5 × 10^5 dyne/cm. and the radius of the group is 1·03 A. The symmetry of H_3BO_3 is probably C_{h3}.

The trigonal symmetry persists in liquid $B(OMe)_3$, which has a quasicryst. structure. It disappears in the Et and higher esters. In $B(OMe)_3$ free rotation about the B–O valencies is hindered. H. J. E.

Raman spectra of organic silicates. B. V. THOSAR and R. N. BAPAT (Z. Physik, 1938, **109**, 472—476).—The Raman spectra of Me, Et, Pr$^{\alpha}$, Bu$^{\alpha}$, and *iso*amyl silicates (exciting line $\lambda = 4358$) are photographed. The four fundamental frequencies of the SiO_4 tetrahedron are obtained. Two of them are ascribed to asymmetric vibration of the SiO_4 group and vary with the alkyl radical, and two to symmetrical vibrations along the Si·O bond, weakening but not changing in frequency, in the order Me → *iso*amyl. L. G. G.

Raman effect and problems of constitution. XI. Glyoxaline.—See A., 1938, II, 294.

Raman effect in solid *cyclo*hexane. S. M. MITRA (Phil. Mag., 1938, [vii], **25**, 895—899).—New frequencies observed at 60 and 105 cm.$^{-1}$ were characteristic of the solid. Each of the lines at 1266 and 1437 cm.$^{-1}$ in the liquid was split into two in the spectrum from the solid; the 2922 cm.$^{-1}$ line was broadened and other lines were unchanged in the solid. H. J. E.

Reflexion coefficients of certain organic substances. J. A. M. VAN LIEMPT (Rec. trav. chim., 1938, **57**, 694—696).—With the aid of a sublimation-pressure formula (A., 1936, 21) reflexion coeffs. can be calc. from Raman frequencies and sublimation pressure data. The vals. of the coeffs. of C_6H_6, p-$C_6H_4Br_2$, and $C_{10}H_8$ are all between 0·99 and 1·0. W. R. A.

Resolution of luminescent spectra excited by ultra-violet light. J. EWLES (Proc. Leeds Phil. Soc., 1938, **3**, 416).—The resolved luminescent bands of CaO excited by cathode rays are also obtained under ultra-violet light excitation. There appears to be a slight shift towards the red, but the frequency difference of 500 cm.$^{-1}$ is maintained. F. J. L.

Fluorescence and absorption of Pr^{+++} and Eu^{+++}. II. H. LANGE (Ann. Physik, 1938, [v], **32**, 361—377; cf. A., 1938, I, 293).—Fluorescence spectra of Eu^{+++} in various salts crystallising in different systems were measured at −180°. Absorption spectra were measured at 20° and −180°. The phosphorescence of mixed phosphors containing alkaline-earth + Eu sulphates varied according to the uniformity of the prep. Results are discussed in relation to splitting of the ground terms of Eu^{+++} in the crystal field. H. C. G.

Cathodo-luminescence spectrum of samarium in solid calcium compounds. E. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 487—503; cf. A., 1934, 345; 1938, I, 176).—Spectra for the Ca salts (calcined with $SmCl_3$ at 800°) of the anions SiO_3'', SO_4'', PO_4''', WO_4'', MoO_4'', F', O'', Al_2O_4'', and B_2O_4'' have been measured in the visible, and compared with similar data, chiefly by Bruninghaus and by Urbain. Sharp bands, usually in 3 groups, vary in λ and intensity with the anion. The extent to which the nature of an activator in natural minerals may be safely inferred from such spectra is illustrated from scheelite, fluorite, and apatite. I. McA.

Rectifying properties of crystals. R. DEAGLIO (Nature, 1938, **141**, 1011).—A discussion (A., 1938, I, 120). L. S. T.

Measurements on complex photo-cathodes. P. GÖRLICH (Z. Physik, 1938, **109**, 374—386).—Transparent films of Bi or Sb were deposited on Ag_2O layers and Cs was allowed to act. Photo-electric current–λ relationships are obtained for the resulting complex photo-cathodes, and from the curves conclusions were drawn as to the mechanism of electron emission. L. G. G.

Semi-conductor in an alternating current. G. DÉCHÊNE (Compt. rend., 1938, **206**, 1558—1560).—A method for determining the effective capacity of the contact between a conductor and a semi-conductor (cf. A., 1938, I, 296), using a.c., is described. A. J. E. W.

Electrical conductivity and thermoelectric properties of semi-conductors. B. M. HOCHBERG and M. S. SOMINSKI (Physikal. Z. Sovietunion, 1938, **13**, 198—223).—Measurements were made of thermo-electric power for the junction Cu–semi-conductor for the semi-conductors WO_3, V_2O_5, CuO, Se, MoS_2, SiC, Bi_2S_2, Tl_2S, and CoO. Comparative measurements of the temp. coeffs. of the electrical conductivity and of the thermoelectric power have been made. A discontinuous variation in direction and magnitude of the thermoelectric power of Tl_2S with its state of oxidation and a similar variation with temp. have been observed. It is concluded that both electron and positive hole diffusion are active in the conductivity of semi-conductors. O. D. S.

Conductivity law of semi-conductors. F. MÖGLICH (Z. Physik, 1938, **109**, 503—509).—Conductivity in semi-conductors is shown to be a consequence of an internal ionisation releasing mobile electrons. The nature of this ionisation is discussed. L. G. G.

Dielectric constant of ionised gases. II. S. GANGOPADHYAYA and S. R. KHASTGIR (Phil. Mag., 1938, [vii], **25**, 883—895; cf. A., 1937, I, 347).—Measurements for ionised air and N_2 are given. At const. tube current the dielectric const. of ionised air decreases $\propto \lambda^2$ to a min. val., and then increases. H. J. E.

Temperature-dependence of the dielectric constant of the gaseous mixture $NO_2 \rightleftharpoons N_2O_4$ and the electric moment of NO_2 and N_2O_4. R. W. SCHULZ (Z. Physik, 1938, **109**, 517—537).—ϵ for $NO_2 \rightleftharpoons N_2O_4$, prepared from $Pb(NO_3)_2$, was determined by a heterodyne method over a temp. range of 70° and at pressures up to 600 mm. Hg. Results are in conflict with those of Williams (cf. A., 1936, 408). The moments of NO_2 and N_2O_4 are respectively 0·29 and 0·37 D. L. G. G.

Calculation of the permanent electric moment of some alkali halides. P. TRAUTTEUR (Nuovo Cim., 1938, **15**, 5—9).—The vals. of μ, calc. by means of Debye's formula, for CsI, KCl, and RbBr are 13·7—14·0, 12·8, and 13·5 D., respectively. The differences

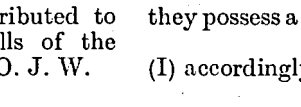
in these vals. from those of $\mu_{obs.}$ are attributed to deformation of the outer electronic shells of the constituent ions. O. J. W.

Dipole moment and structure of morpholine. J. R. PARTINGTON and D. I. COOMBER (Nature, 1938, **141**, 918).—The dipole moment (in C_6H_6 at 20°) is 1·48 D. The two Sachse *Z*-forms, the two symmetrical and the two unsymmetrical *U*-forms which are possible, are shown diagrammatically. Moments are calc. for these structures and the val. 1·48 agrees with either of the two *Z*-forms, whilst comparison with the results for dioxan indicates that this is the most probable interpretation. The possibility of small amounts of the four *U*-forms is not excluded. L. S. T.

Chemical war materials. VII. Dipole moments of nose- and throat-irritant materials (blue cross war materials). VIII. Dipole moments of lung poisons (green cross war materials). IX. Dipole moments of skin poisons (yellow cross war materials). H. MOHLER (Helv. Chim. Acta, 1938, **21**, 784—786, 787—788, 789—792; cf. A., 1938, 1, 121).—From measurements on dil. solutions in C_6H_{14} or C_6H_6 the following dipole moments (in D.) have been determined: $AsPh_2Cl$ 2·70, $AsPh_2{\cdot}CN$ 4·19, phenarsazine chloride 2·26, $ClCO_2Me$ 2·22, $ClCO_2CCl_3$ 2·16, $CCl_3{\cdot}NO_2$ 1·91, $AsEtCl_2$ 2·51, $CHCl{:}CHAsCl_2$ 1·77, $(CHCl{:}CH)_2AsCl$ 1·45, $As(CH{:}CHCl)_3$ 0·39, $(CH_2Cl{\cdot}CH_2)_2S$ 1·76. J. W. S.

Dielectric constant and conductivity of soil at high radio frequencies. S. S. BANERJEE and R. D. JOSHI (Phil. Mag., 1938, [vii], **25**, 1025—1033).—Measurements have been made by determining the actual attenuation of the waves in the soil. Conductivity increases with frequency and moisture content and is of the order 10^6 e.s.u. Dielectric const. falls with rise of frequency but rises with moisture content from 4·5 with 6·3% H_2O to 17·3 with 13·9%. Change of the attenuation const. is not very regular but is usually higher for moist soil and high frequencies. For Indian soil both conductivity and dielectric const. are < for soil from other countries. T. H. G.

Necessary corrections of the modern theory of complex compounds. B. ORMONT (J. Phys. Chem. Russ., 1938, **11**, 274—277).—When establishing a theory of complex compounds the nuclei must be taken into account; the theories considering electrons only are insufficient. J. J. B.

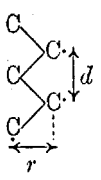
Constitution of complex metallic salts. VII. Structure and configuration of the bridged derivatives of trimethylarsine with palladous halides. F. G. MANN and A. F. WELLS (J.C.S., 1938, 702—710; cf. A., 1936, 1496).—The bridged derivatives of the trialkyl-phosphines and -arsines with Pd^{II} halides, *e.g.*, $[PR_3,PdCl_2]_2$, exist, in the solid state, in only one of three possible isomeric forms which, in org. solvents, are all present in tautomeric equilibrium. The isomorphous members, $[AsMe_3,PdCl_2]_2$ (I) and $[AsMe_3,PdBr_2]_2$ (II), have been examined crystallographically. The mols. are planar, and the crystal is built up from parallel layers of such mols.; they possess a diad axis of symmetry. The structure of (I) accordingly is  . The unit cell contains 4 mols., and their orientation in the crystal, interat. distances, and bond angles have been determined. Differences in the types of crystals of (I) and (II) obtained from EtOH and from dioxan, are discussed. $[AsMe_3,PdClBr]_2$ (III), $[AsMe_3,PdCl(SCN)]_2$, and $[AsMe_3,PdBr(SCN)]_2$ have been prepared and the nature of the bridging in each is discussed. Three cryst. forms of (III) have been obtained and examined. The phosphine analogue of (I) is not isomorphous with (I). The existence of the bridged linking of metallic atoms through acid radicals is reviewed briefly and it is shown that the groups —Cl→, —O—, —OH→, —S—, —SEt→, —SCN→, —NH_2→, and —NH— can all give 4-membered rings when two such groups bridge two metallic atoms, whilst, under similar circumstances, rings containing >4 atoms are formed with the groups —O—CMe=O→, —O—SO_2—O—, —O—SO_2—S—, —N(→O)=O→, and —O—O—. An improved prep. of PMe_3 and of dichlorobis(trimethylarsine)palladium, $[(AsMe_3)_2PdCl_2]$, is given. The following are described: *dibromobis(trimethylarsine)palladium*, $[(AsMe_3)_2PdBr_2]$, m.p. 229°; *dibromobis(trimethylarsine)-μ-dibromodipalladium* [= (II) above], decomp. 258—260° with previous darkening but without melting; *dichlorobis(trimethylarsine)-μ-dibromodipalladium* [= (III) above], darkened on heating at 230° and had decomposed at 248°; *dithiocyanatobis(trimethylarsine)palladium*, $[(AsMe_3)_2Pd(SCN)_2]$, m.p. 124°; *dihalogenobis(trimethylarsine)-μ-dithiocyanatodipalladium*, $[AsMe_3,PdX(SCN)]_2$, X = *Cl*, m.p. 192—193° (decomp.), *Br*, m.p. 189—190° (decomp.); *dinitrobis(trimethylarsine)palladium*, $[(AsMe_3)_2Pd(NO_2)_2]$, m.p. 234° (decomp.); *dichlorobis(trimethylarsine)-μ-dinitrodipalladium*, $[AsMe_3,Pd(NO_2)Cl]_2$, m.p. 186—188° (decomp. after softening); *dichlorobis(trimethylphosphine)palladium*, $[(PMe_3)_2PdCl_2]$, m.p. 282° (decomp.); *dichlorobis(trimethylphosphine)-μ-dichlorodipalladium*, $[PMe_3,PdCl_2]_2$, m.p. 285° (decomp.); *di-iodobis(tri-n-propylphosphine)-μ-di-iododimercury*, $[PPr^n_3,HgI_2]_2$, occurs in two forms, white, m.p. 114°, and yellow, convertible into the white form by heating. W. R. A.

Dimensional considerations in continuum physics. R. FÜRTH (Ann. Physik, 1938, [v], **32**, 336—346).—Dimensions of physical consts. for the reversible and irreversible properties of matter in the solid, liquid, and liquid-cryst. states are discussed. H. C. G.

Most probable excitation energy of the hydrogen molecule observed experimentally. S. G. COLES and R. WHIDDINGTON (Proc. Leeds Phil. Soc., 1938, **3**, 401—402).—Using the magnetic spectrum method vals. between 12·4 and 12·9 v. are deduced from observation of the "loss band." F. J. L.

Internuclear distance in the fluorine molecule. L. O. BROCKWAY (J. Amer. Chem. Soc., 1938, **60**, 1348—1349).—Electron-diffraction measurements give 1·45±0·05 A., which is about 14% > the val. expected for a normal, single covalent linking. E. S. H.

Length of aliphatic carbon [C–C] link. C. H. MACGILLAVRY (Z. Krist., 1938, **98**, 407—410).—



Assuming the plane zig-zag C chain (fig.), the C–C link is determined from d and r. Müller's (X-ray) r and interpretation are questioned; the val. 0·82±0·11 A., determined from Müller's cell dimensions and Trillat's electron diffraction ($hk0$) intensities for a long-chain n-paraffin, accords with Hengstenberg's X-ray val. With d 2·54 A. (X-ray), C–C is thus 1·52±0·07 A.

I. McA.

Deformations of valency angles according to absorption spectra; structures of benzocyclanones, their oximes, and benzocyclenes.—See A., 1938, II, 327.

Surface tension of liquid helium. J. F. ALLEN and A. D. MISENER (Proc. Camb. Phil. Soc., 1938, **34**, 299—300).—The surface tension of liquid He between 1° and 5° K. has been measured by the capillary-rise method. There is no apparent discontinuity at the transition point. F. J. L.

Computation of three-dimensional Fourier syntheses in crystal structure analysis. T. H. GOODWIN and R. HARDY (Phil. Mag., 1938, [vii], **25**, 1096—1104).—Complete resolution of all the atoms in a unit cell may not be possible from two-dimensional Fourier projections but must result from three-dimensional syntheses if sufficient terms are used. The stages by which such syntheses are carried out are described for the most general (completely asymmetric) case and special attention is given to summations over planes such as (xyz_1) and along lines such as (x_1y_1z). T. H. G.

Intense monochromatic beams of X-rays. I. FANKUCHEN (Physical Rev., 1938, [ii], **53**, 910; cf. A., 1937, I, 152).—An amplification of discussions by Bozorth (cf. A., 1938, I, 300). N. M. B.

New type of X-ray diagram. A. GUINIER (Compt. rend., 1938, **206**, 1641—1643).—The occurrence of diagrams containing straight lines or diffuse spots of low intensity radiating irregularly from the central spot is described. Such diagrams have been obtained with a supersaturated Al–Cu solid solution, using monochromatic radiation; in this case they may be due to reflexion at plane aggregates of Cu atoms of small thickness, distributed irregularly but parallel to each other throughout the crystal. The diameter (~150 A.) and thickness (~3—4 A.) of these aggregates can be deduced from the diagram obtained.

A. J. E. W.

Radial lines in Laue spot photographs. (A) A. P. R. WADLUND. (B) W. H. ZACHARIASEN (Physical Rev., 1938, [ii], **53**, 843, 844).—(A) Unexplained radial lines with marked structure have been observed on Laue photographs only in the case of NaCl and KCl crystals.

(B) It is suggested that the lines are due to two-dimensional lattice effects, observable in the case of NaCl and KCl owing to the pronounced mosaic character of the crystals. A mathematical treatment is developed. N. M. B.

Detection of lattice disturbances and determination of particle sizes with X-rays. R. FRICKE (Z. Elektrochem., 1938, **44**, 291—295).—The effect of various types of lattice disturbances, of small size of primary particles, and of admixture of amorphous material on the widths and intensities of X-ray lines are discussed. F. J. G.

Structure of the real crystal system. D. BALAREV (Österr. Chem.-Ztg., 1938, **41**, 235—242).—The author's views on the non-homogeneity of real crystals are summarised and discussed. J. W. S.

Velocity of crystallisation of sodium and the connexion between the atomic heat of fusion and velocity of crystallisation of the elements. J. CZOCHRALSKI and W. GARLICKA (Wiadom. Inst. Met., 1936, **3**, 39—44; Chem. Zentr., 1936, ii, 1845).—The velocity of crystallisation of Na, melted under xylene, increases with temp. Dendritic crystals are obtained below 98°, and cylindrical crystals above this temp. Comparison of the atm. heat of crystallisation and velocity of crystallisation of Au, Al, Sn, Pb, and Na shows that velocity decreases with increasing heat of crystallisation. L. S. T.

Quasi-crystalline and crystalline liquids. F. C. FRANK (Physikal. Z., 1938, **39**, 530—534).—Theoretical. Two non-adjacent mols. can only remain parallel to one another if there is a "chain" of parallel mols. between them. The maintenance of the parallelism is dependent on the ratio of the probabilities of branching and of rupture of the "chain." If this is <1 the parallelism is limited to a finite range, whereas if it is equal to 1 it may go on indefinitely. The effect of small deviations from parallelism is considered. A. J. M.

Precision determination of lattice constants of hygroscopic compounds (LiCl, NaBr). A. IEVIŅŠ, M. STRAUMANIS, and K. KARLSONS (Z. physikal. Chem., 1938, **B**, **40**, 146—150; cf. A., 1936, 273).—Precautions necessary for the prep. of the specimen and for its examination by the powder method are described. The lattice consts. of LiCl and NaBr at 25° are 5·12952±0·00004 A. and 5·96095 ±0·00005 A., respectively. The expansion coeffs. are $44{\cdot}76 \times 10^{-6}$ and $42{\cdot}52 \times 10^{-6}$, respectively.

H. J. E.

Configuration of a pentahalogen anion group from the X-ray structure determination of potassium tetrachloroiodide crystals. R. C. L. MOONEY (Z. Krist., 1938, **98**, 377—393; cf. A., 1938, I, 347).—By Laue and oscillation X-radiograms, the monoclinic cell of $KICl_4$ contains 4 mols. with a 13·09, b 14·18, c 4·20 A., β 95° 7′; $\rho_{calc.}$ 2·62; space-group C_{2h}^5 ($P2_1/n$). Complete at. parameters and interdistances are determined in fair agreement with >200 visual intensities. In the complex $(ICl_4)'$ anion, 4 Cl at the corners of a square are linked to a central coplanar I by quadricovalency at 2·34 A. The structure, which involves a close-packing of $(ICl_4)'$ with a loose 6-co-ordination of K–Cl (at ~ 3·32 A.), is discussed in relation to binding and stability. I. McA.

Oxygen parameters for [crystal structure of] $NaIO_4$. E. A. HAZLEWOOD (Z. Krist., 1938, **98**,

439—446).—The tetragonal cell has a 5·3222± 0·0004, c 11·93 A.; the space-group C_{4h}^6 (A., 1938, I, 125) is confirmed. The O parameters, x 0·220, y 0·159, z 0·089, derived from analysis of (00l) and (hk0) integrated intensities (using a spectrometer with Geiger–Müller counter, amplifier, and thyratron system) are confirmed by sensitive analysis of oscillation photograms. Each Na is 8-co-ordinated to equidistant O at 2·575 A. $(IO_4)'$ is a regular tetrahedron (O at corners, central I) with I—O 1·792, O—O 2·67 A. I. McA.

Structure of sodium *iso*cyanate. M. Bassière (Compt. rend., 1938, **206**, 1309—1311).—The structure is analogous to that of NaN_3. The unit cell, containing one mol., has a 3·576, c 15·10 A.; space-group C_{3v}^5 or $R3m$. The at. parameters give the interat. distances C—N 1·21, C—O 1·13 A., and confirm that the CNO group is linear and has the structure ·N:C:O. A. J. E. W.

Crystal structure of acetaldehyde–ammonia "CH_3·CHO·NH_3." N. F. Moerman (Z. Krist., 1938, **98**, 447—455).—*X*-Ray analysis shows the rhombohedral cell with a 8·36 A., α 84°, to contain 6 C_2H_7ON; ρ 1·06; space-group D_{3d}^5. A structure, with approx. parameters and interdistances for the groups CH, NH, H_2O, and Me, is determined in accord with chemical facts and crystal symmetry, optics, cleavage, cell dimensions, and estimated *X*-ray intensities. 6 H_2O linked by the ice-type OH bond (Bernal, A., 1934, 13) form a central puckered O-hexagon (I) (angle O–O–O ~110°) between 2 normally bonded "armchair" hexagon trimerides $(CHMe·NH)_3$ (II), with the Me outside. 3 N of each of (II) are linked by H bonds to alternate O of (I). I. McA.

***X*-Ray analysis of definite single crystals of cetyl palmitate.** R. Kohlhaas (Z. Krist., 1938, **98**, 418—438; cf. A., 1937, I, 502).—Thermal and optical analysis from 20° to 54° (m.p.) shows no structural transitions in crystals obtained from amyl butyrate. From Laue, rotation, and Schiebold–Sauter *X*-radiograms, the monoclinic cell has a 5·61, b 7·42, c sin β 77·88 A., β 61·3°; ρ 0·989; 4 mols. per cell; space-group probably C_{2h}^5 — $P2_1/c$. Discussion of the structure is based on some 140 indexed intensities. Dicetyl ether is monoclinic with a 5·49, b 7·45, c sin β 38·97n A., β 63·2°; ρ 0·978. I. McA.

Calibration substances for electron diffraction. N. A. Schischacov (Physikal. Z. Sovietunion, 1937, **12**, 20—22).—Choice of standard specimens for determination of λ in electron diffraction experiments is described. Two-dimensional crystals of Si_2O_5 are recommended and the method of prep. is given. The hexagonal lattice const. a = 5·161 A. (±0·3%). J. A. D.

Molecular structure of selenium dioxide vapour. K. J. Palmer and N. Elliott (J. Amer. Chem. Soc., 1938, **60**, 1309—1310).—Electron-diffraction data yield the val. 1·61±0·03 A. for the Se—O distance. E. S. H.

Electron diffraction by Sb_2O_3 on Sb_2S_3. S. Miyake (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 565—583).—Reflexion photographs from oxidised Sb_2S_3 gave three types of patterns according to the heating: (1) ring patterns of Sb_2O_3; (2) spot patterns of Sb_2O_3, oriented along the lattice of the base crystal; (3) ring patterns from Sb_2O_4 also showing evidence of orientation. Forbidden spots, spots with irrational indices, and refraction phenomena were observed and are discussed in terms of Laue's dynamical theory of diffraction. Crystal dimensions are estimated; the inner potential of Sb_2O_3 is 17 v. J. A. D.

Ferromagnetic anisotropy of nickel–iron crystals at various temperatures. J. D. Kleis (Physical Rev., 1938, [ii], **53**, 848; cf. A., 1937, I, 120).—A correction. N. M. B.

Effect of lattice discontinuities on the magnetic properties of magnetite. D. J. Doan (U.S. Bur. Mines, 1938, Rept. Invest. 3400, 65—86).—The magnetic properties of magnetite were studied in view of the possibility of developing separation in an alternating magnetic field. The relation between lattice structure and magnetic properties is discussed. A Fe_3O_4–Fe_2O_3 mixture (prepared by heating Fe_2O_3) showed max. "age-hardening" effects at 400—700°, the behaviour being similar to that of Fe alloys. The magnetic properties of Fe_3O_4, made by reducing Fe_2O_3, are correlated with the *X*-ray structure. The coercive form of the product is related to the reducing temp. and the type of gas used. The magnetic effects of applied mechanical stresses were observed. S. J. K.

Deformation of crystalline matter. A. Pistocchi (Alluminio, 1938, **7**, 3—13).—A general survey of interat. forces in crystals. O. J. W.

Plastic deformation of rock-salt. IV. N. A. Brilliantov and I. V. Obreimov (Physikal. Z. Sovietunion, 1937, **12**, 7—19; cf. A., 1935, 1311).—A method of obtaining large twins of NaCl by plastic deformation is described. Optical measurements of the angle between the facets are compared with *X*-ray measurements of the angles between the twinned crystals and show that pure translation does not occur. When NaCl is deformed a birefringent stripe appears as boundary between the twins, and this stripe is coloured more intensely by *X*-rays than the rest of the crystal. J. A. D.

Liquid crystals and anisotropic solutions. A. S. C. Lawrence (J. Roy. Microscop. Soc., 1938, [iii], **58**, 30—48; cf. A., 1933, 1108).—A lecture. I. McA.

Contact potential between liquid and solid zinc at the m.p. H. Kurzke and J. Rottgardt (Z. Physik, 1938, **109**, 341—348).—The contact p.d. between liquid and solid Zn, determined from measurements of photoelectric saturation currents, is ~ —0·2 v. H. C. G.

Sintering of metal powders. G. Grube and H. Schlecht (Z. Elektrochem., 1938, **44**, 367—374).—Data are recorded for the influence of sintering temp. on the density, electrical conductivity, Brinell hardness, and tensile strength of powders of Mo and Ni compressed at pressure > 10,000 kg. per sq. cm. C. R. H.

Electrical resistances of the alkali metals. M. Lemarchands and L. Rougeot (Bull. Soc. chim.,

1938, [v], **5**, 910—915).—The sp. resistances (ρ) of solid K, Rb, and Cs at temp. T can be expressed by relations of the form $\rho = 2\sqrt{\gamma} \cdot ZT_f \cdot T(1 + T/2T_f) \times 10^{-6}$, where T_f is the m.p., Z the at. no., and γ the ratio of the sp. heats. This relation holds also for Na if Z is replaced by $Z + 1$. J. W. S.

Specific resistance and temperature variation of resistance of tin crystals. B. CHALMERS and R. H. HUMPHRY (Phil. Mag., 1938, [vii], **25**, 1108—1113).—Measurements have been made with the c-axis parallel and perpendicular to the axis of single crystals of β-Sn (purity 99·987% and 99·996%). The effect of this difference in purity is only just perceptible but is greater in the "parallel" experiments. T. H. G.

Measurements on selenium photo-elements. H. SCHWEICKERT (Z. Physik, 1938, **109**, 413—430).—Resistance and capacity measurements on Se photo-electric cells prove the existence of a boundary layer the properties of which determine the total electrical output and the observed e.m.f. on illumination. In contradiction to other authors, change of resistance of the boundary layer is not observed on illumination and this fact allows the determination of the energy distribution of electrons from the covering electrode. The quantum yield on short-circuit is between 0·5 and 1·0. L. G. G.

Magnetism and chemistry. H. HARALDSEN (Tids. Kjemi, 1938, **18**, 69—74).—A review. M. H. M. A.

Magnetism and valency of the atoms in metallic phases. E. VOGT (Angew. Chem., 1938, **51**, 361—365).—A review of the characteristics and causes of the types of magnetism occurring in metals and alloys. The topics discussed include the magnetism of the rare-earth and transition metals, and electron transfers occurring on formation of alloys. A. J. E. W.

Theory of the magnetic anisotropy of cubic crystals at the absolute zero. W. F. VAN PEYPE (Physica, 1938, **5**, 465—482).—An extension of previous work (A., 1931, 1003), based on Heisenberg's theory. A. J. E. W.

Time of relaxation due to spin–spin interaction in paramagnetic crystals. R. DE L. KRONIG and C. J. BOUWKAMP (Physica, 1938, **5**, 521—528; cf. A., 1933, 117).—Theoretical. A. J. E. W.

Paramagnetic relaxation in iron ammonium alum at low temperatures. W. J. DE HAAS and F. K. DU PRÉ (Physica, 1938, **5**, 501—506).—The differential magnetic susceptibility χ' of $Fe(NH_4)_2(SO_4)_2,12H_2O$ has been measured at 1·22 and 1·65° K., using a small a.c. field (frequency ν) superposed on a parallel const. field. χ' shows considerable dependence on ν for $\nu \sim 15$ cycles, and it is concluded that the relaxation time for the spin-lattice equilibrium is $\ll$ the val. (100 sec.) predicted by Heitler and Teller (A., 1936, 1191). χ' is not measurably decreased by a transverse const. field. A. J. E. W.

Thermodynamic interpretation of paramagnetic relaxation phenomena. H. B. G. CASIMIR and F. K. DU PRÉ (Physica, 1938, **5**, 507—511).—The results of experiments with $Fe(NH_4)_2(SO_4)_2,12H_2O$ (cf. preceding abstract) are considered. The relaxation time, τ, of the spin-lattice equilibrium is 0·2—2 $\times$ 10^{-2} sec. in a magnetic field of 0—2500 gauss. A. J. E. W.

Magnetic susceptibility of liquid nitric oxide, NO. H. BIZETTE and B. TSAÏ (Compt. rend., 1938, **206**, 1288—1289).—$\kappa = 3{\cdot}53 \times 10^{-6}$ c.g.s. unit at −163°. This val. indicates that liquid NO at −163° is 97% polymerised to $(NO)_2$ (cf. also A., 1937, 1, 397). A. J. E. W.

Magnetic anisotropy of some mixed Tutton salts. M. S. JOGLEKAR (Z. Krist., 1938, **98**, 411—417; cf. A., 1936, 1057).—To determine the effect of the cryst. electric field on the anisotropy of paramagnetic ions, mixed crystals $P + nD$ (n by analysis) have been prepared from the isomorphous $MSO_4,(NH_4)_2SO_4,6H_2O$ (M = Fe, Co, Ni, or Cu: paramagnetic P; M = Mg or Zn: diamagnetic D) and $\chi_1 - \chi_2$, $\chi_1 - \chi_3$, and ψ (A., 1933, 664) measured at 30° in a uniform magnetic field. The effect of magnetic dilution on the anisotropies is most marked in Co, and for Mg and Zn on Co or Fe is in opposite senses, as expected from the ionic radii. I. McA.

Magnetic anisotropies and molecular orientations in crystals of acenaphthene. J. SHANKER and M. PRASAD (Current Sci., 1938, **6**, 554—555; cf. A., 1938, I, 68).—Assuming isotropic $>CH_2$ contributions, mol. susceptibilities, $K_{1, 2, 3}$ for acenaphthene of −74·9, −72·7, and −187·8 (all $\times 10^{-6}$), respectively, are derived from corr. vals. (A., 1937, I, 18) for $C_{10}H_8$. These confirm a mol. axis of symmetry parallel to [010], and give 37° 30′ for the angle (α) between the mol. plane and (001). In a comparison with a like analysis by Banerjee and Sinha (A., 1937, 1, 289), the (X-ray) α val. 26° is questioned. I. McA.

Velocity of sound in liquid helium. E. F. BURTON (Nature, 1938, **141**, 970—971).—Determinations of the velocity of sound in He I and He II are recorded in a curve showing the change in velocity with temp. The velocity at points somewhat removed from the λ-point agrees approx. with the vals. calc. from estimated adiabatic elasticities. The occurrence of the discontinuity expected at this point is doubtful. L. S. T.

Velocity of sound in liquid nitrogen. E. HIRSCHLAFF (Proc. Camb. Phil. Soc., 1938, **34**, 296—298).—The velocity of sound in liquid N_2 at 75—55° K. has been determined by measuring the distance between the interference fringes formed when standing suprasonic waves set up in the liquid by means of a piezo-electric quartz are illuminated with Hg light $\lambda = 5461$ A. F. J. L.

Reflexion of sound. K. F. HERZFELD (Physical Rev., 1938, [ii], **53**, 899—906).—Mathematical. The losses in the reflexion of sound on solids are investigated. The heat conduction of the solid disturbs the temp. distribution in the gas and sets up a temp. wave. Effects which become important only at higher frequencies (scattering of the mols. on the wall, scattering of the sound wave by uneven places) and the effect of adsorption are also investigated. N. M. B.

Transparency of solid plates to ultrasonic waves. E. BAUMGARDT (Compt. rend., 1938, **206**,

1284—1286).—Vals. of Young's modulus for Fe and mild steel, deduced from the optimum thickness of plates transparent to ultrasonic waves, are independent of the frequency and are in agreement with the static vals. The velocity of propagation through plates is thus equal to that in an extended medium. A. J. E. W.

Thermal equilibrium at temperatures below 1° K. E. S. SHIRE (Proc. Camb. Phil. Soc., 1938, **34**, 301—307).—The time for thermal equilibrium between the ionic magnets and the lattice vibrations of Fe NH_4 alum crystals is <0·5 sec. for all temp. above 0·025° K. F. J.L.

Collective electron energy and specific heat. E. C. STONER (Phil. Mag., 1938, [vii], **25**, 899—926).—Theoretical. H. J. E.

Specific heats and heat of fusion of iodine. K. J. FREDERICK and J. H. HILDEBRAND (J. Amer. Chem. Soc., 1938, **60**, 1436—1439).—The heat of fusion, determined by the method of mixtures, is 3740±20 g.-cal. per mol. The mol. heat capacity of solid I at 25—113·6° is given by $c_p = 13{\cdot}07 + 3{\cdot}21 \times 10^{-4}(t - 25)^2$; that of liquid I from the m.p. to 160° is 19·5±0·3 g.-cal. E. S. H.

Specific heat of the alkalis. L. G. CARPENTER, T. F. HARLE, and C. J. STEWARD (Nature, 1938, **141**, 1015—1016).—Measurements of the true sp. heat of K between −70° and 336° show the normal tendency to reach a const. val. ~3*R*, followed by an abnormal rise of sp. heat commencing at room temp. and extending to the m.p. The abnormal rise of sp. heat extending over a considerable range below the m.p. appears to be common to K, Li, and Na. L. S. T.

Heat of formation and specific heat of tantalum nitride. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 477—486; cf. A., 1934, 966).—Using TaN containing 6·50% of free Ta, measurements (cf. A., 1936, 565) over the intervals 0—100°, 0—305°, and 0—500° give for the mean sp. heat of pure TaN the vals. 0·05117, 0·05683, and 0·06068, respectively, whence the sp. heat–temp. relation: $C = 0{\cdot}04785 + 7{\cdot}068 \times 10^{-5}\theta - 5{\cdot}808 \times 10^{-8}\theta^2$. Using this, the Nernst heat theorem, and high-temp. equilibrium data (by Andrews), Ta + N = TaN + 58·65 kg.-cal. at 25°, confirming Neumann *et al.* The heats of formation of nitrides are discussed in relation to at. no. I. McA.

Sulphur dioxide. Heat capacity of solid and liquid. Vapour pressure. Heat of vaporisation. Entropy values from thermal and molecular data. W. F. GIAUQUE and C. C. STEPHENSON (J. Amer. Chem. Soc., 1938, **60**, 1389—1394).—Heat capacity data from 15° K. to the b.p. are recorded. SO_2 has m.p. 197·64° K., b.p. 263·08° K., heat of fusion 1769·1 g.-cal. per mol., heat of vaporisation 5960 g.-cal. per mol. The v.p. from m.p. to b.p. is given by $\log_{10} P_{(\text{internat. cm. Hg})} = -1867{\cdot}52/T - 0{\cdot}015865T + 0{\cdot}0000155747T^2 + 12{\cdot}07540$. The entropy of SO_2 gas at the b.p., derived from calorimetric data, is 58·07 g.-cal. per degree per mol.; $S^\circ_{298{\cdot}1} = 59{\cdot}23$, in agreement with the val. calc. from available mol. data. The agreement shows that the entropy of SO_2 approaches 0 at 0° K. The linking angle of SO_2, calc. from the entropy, is 129±4°. E. S. H.

Heat of formation and specific heat of Ca_3N_2. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 534—595).—The sp. heat of Ca_3N_2 determined by the ice calorimeter is given by $C = 0{\cdot}1817 + 1{\cdot}273 \times 10^{-4}\theta + 1{\cdot}388 \times 10^{-8}\theta^2$ after corrections have been made for the presence of Mg_3N_2 and CaO as impurities. The heat of formation of Ca_3N_2 was calc. from the dissociation pressure $3Ca + N_2 = Ca_3N_2 + 108{,}200$ g.-cal. J. A. D.

Heat of formation of zinc sulphide. A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1938, **11**, 220—227).—The heat of formation of wurtzite from sublimed Zn and rhombic S is 45·2 kg.-cal., and that of Zn blende is 48·4 kg.-cal. J. J. B.

Heat of formation of [iron and] cadmium sulphides. A. F. KAPUSTINSKI and I. A. KORSCHUNOV (J. Phys. Chem. Russ., 1938, **11**, 213—219).—FeS and CdS were prepared in a calorimeter from rhombic S and reduced Fe and sublimed Cd, respectively. The heats of formation were 22·3 and 34·5 kg.-cal. respectively. J. J. B.

Specific heat of carbon dioxide at low temperatures. S. C. SIRKAR and J. GUPTA (Nature, 1938, **141**, 915—916).—Comparison of observed vals. of C_p with calc. vals. for C_v at low temp. indicates that, besides the lattice oscillations, there is another which corresponds with the new Raman line (58 cm.$^{-1}$) observed in CO_2 (A., 1938, I, 61) at low temp. This appears to take place in pairs of CO_2 mols., members of each pair being connected by a weak electronic bond. L. S. T.

Thermal data on organic compounds. XVIII. Heat capacity and entropy of *tert.*-butylethylene. W. D. KENNEDY, C. H. SHOMATE, and G. S. PARKS (J. Amer. Chem. Soc., 1938, **60**, 1507—1509).—Heat capacities have been determined at 80—298° K. The calc. mol. entropy at 298·1° K. is 61·3 g.-cal. per degree. A transition point between two cryst. forms occurs at 124·9° K.; the heat of transition is 12·35 and the heat of fusion 3·11 g.-cal. per g. The calc. free energy of dehydrogenation of ββ-dimethylbutane is 21,700± 500 g.-cal. E. S. H.

Physico-chemical properties of the alkali metals. M. LEMARCHANDS and L. ROUGEOT (Bull. Soc. chim., 1938, [v], **5**, 901—910).—The m.p., b.p. at 760 mm. and at 1 mm., entropy change during evaporation, and mol. heats of sublimation of alkali metals can all be expressed by formulæ of the type $x = a + b\gamma/\log_{10} Z$, where *a* and *b* are consts. for each property, γ is the ratio of the sp. heats (1·667), and *Z* is the at. no. Results for Li are always anomalous, whilst some deviations are also observed for Na. Expressions for the heats of ionisation and heats of formation of the oxides are also discussed. J. W. S.

B.p. of benzene, ethylene chloride, *n*-heptane, and ββδ-trimethylpentane over the range 660 to 860 mm. pressure. E. R. SMITH and H. MATHESON (J. Res. Nat. Bur. Stand., 1938, **20**, 641—650).—Data for the above liquids were obtained by the comparative ebulliometric method, using H_2O as the reference standard. Equations for each liquid expressing the

relation between temp. and v.p. from 660 to 860 mm. are given. D. F. R.

B.p. and chemical constitution. I. An additive function of mol. wt. and b.p. V. C. E. BURNOP (J.C.S., 1938, 826—829).—Between the mol. wt. (M) and the abs. b.p. (T) there exists, for an homologous series of non-associating compounds, an additive empirical relation, $M \log_{10} T + 8{\cdot}0M^{\frac{1}{2}}$. The vals. of this relation, b, are given for series of normal paraffins, olefines, diolefines, acetylenes, *cyclo*paraffins, aromatic hydrocarbons, alkyl halides, ethers, esters, ketones, and amines. From these at. and structural contributions to b are derived. W. R. A.

Stefan's law and non-linear electrodynamics. B. KWAL and J. SOLOMON (J. Phys. Radium, 1938, [vii], **9**, 205—208).—Mathematical. The consequences of abandoning the linearity of the equations of electrodynamics are considered for Stefan's law and for Wien's displacement law. W. R. A.

Density differences at the critical point according to R. Plank's equation of state. R. RUEDY (Canad. J. Res., 1938, **16, A**, 89—99).—This equation leads to possible differences of 5% in densities measured at heights differing by 1 cm. in gases at the crit. point, and so large corrections are needed unless the material is agitated continually. Van der Waals' equation shows that the difference in level $\Delta h \propto$ third power of the relative difference in density $\Delta d = (d - d_c)/d_c$; Wohl's equation leads to $\Delta h \propto (\Delta d)^4$, and Plank's to $\Delta h \propto (\Delta d)^5$. T. H. G.

Low vapour pressures of alkali halides. J. E. MAYER and I. H. WINTNER (J. Chem. Physics, 1938, **6**, 301—306).—V.p. over cryst. NaCl, KCl, RbCl, NaBr, KBr, and RbBr have been measured by Knudsen's method at approx. 900° K. and the heats of vaporisation evaluated. W. R. A.

Experiments at low temperatures. J. D. COCKCROFT (Nuovo Cim., 1938, **15**, 35—40).—An account of thermal conductivity measurements of liquid He. O. J. W.

Thermal expansion and conductivity in liquid helium II. H. JONES (Proc. Phil. Camb. Soc., 1938, **34**, 253—261).—The negative coeff. of thermal expansion of He II is a consequence of the disordering process taking place with rising temp. The thermal energy of He II is mainly energy of disorder. A theory of heat conduction, considered as a flow of disorder, is shown to be compatible with the experimental data at present available. F. J. L.

Thermal conductivity of gaseous hydrocarbons and atomic polarisation. R. DELAPLACE (Compt. rend., 1938, **206**, 1646—1647).—Anomalies in the relative thermal conductivities in groups of isomeric hydrocarbons are shown to correspond with anomalies in the at. polarisation vals., confirming that the dynamic structure of the mol. is a factor affecting heat transfer between gas mols. and a surface. A. J. E. W.

Coefficient of expansion of barium and calcium and allotropy. P. G. CATH and O. L. VON STEENIS (Z. tech. Physik, 1936, **17**, 239—241; Chem. Zentr., 1936, ii, 1845).—Between 0° and 300°, the coeff. of linear expansion of Ba fluctuates between 170 and 210×10^{-7}, and is markedly dependent on previous thermal treatment. An arrest at 390° corresponds with the two different modifications. Ca behaves in a similar, but less marked, way. Below 300°, the coeff. is 220×10^{-7}. L. S. T.

Thermal constants at high temperatures. II. Thermal expansion of rock-salt. III. Anomalous thermal expansion of bismuth, zinc, and cadmium near the m.p. V. F. HASCHKOVSKI and P. G. STRELKOV. **IV. Coefficient of expansion of silver chloride and bromide.** P. G. STRELKOV (Physikal. Z. Sovietunion, 1937, **12**, 35—44, 45—72, 73—82).—II. The thermal expansion coeff. of NaCl has been measured, using an interference method and also the quartz dilatometer (cf. A., 1938, I, 417). The total expansion from 0° K. to the m.p. is approx. 6%. An empirical formula for the variation of the coeff. with temp. is given.

III. Bi begins to show anomalous expansion at 40° below the m.p., Zn and Cd at approx. 10° below the m.p. The anomaly increases as the m.p. is reached and has the same sign as the vol. change on melting.

IV. The variation of the coeff. for AgCl and AgBr with temp. has been measured, and its relation to the electrical polarisation of the crystal is considered. The effect of small amounts of AgBr and NaCl on the temp. variation of the expansion coeff. of AgCl has also been examined. J. A. D.

Thermal conductivity at low temperatures. W. J. DE HAAS (Nature, 1938, **141**, 1053; cf. A., 1938, I, 304).—The dependence of the heat-conductivity of quartz on crystal size has been determined at 2·5°, 2·9°, and 3·3° K. For SiO_2 and KCl the heat-resistance is a function of the radius. With increasing thickness, the sp. resistance approaches a const. val. asymptotically. It is assumed that resistance is due to scattering by the surface and by the mosaic structure, and to scattering of the elastic waves by one another. L. S. T.

Viscosity of air and the electronic charge. G. B. BANERJEA and B. PATTANAIK (Nature, 1938, **141**, 1016—1017).—A redetermination gives for the η of dry air at 23° the val. $(1833{\cdot}3 \pm 2{\cdot}1) \times 10^{-7}$ c.g.s. unit. The increase per °C. is $4{\cdot}95 \times 10^{-7}$ unit. Substitution of this val. of η in Millikan's data for the oil-drop experiment gives $e = (4{\cdot}811 \pm 0{\cdot}009) \times 10^{-10}$ e.s.u. compared with the X-ray val. of $4{\cdot}807 \times 10^{-10}$. L. S. T.

Molecular force and viscosity of gases. W. WEN-PO (Phil. Mag., 1938, [vii], **25**, 865—883).—A theoretical treatment of mol. interaction, assuming spherical symmetry of the mols., leads to the equation $\rho_l^{2/3} T^{1/2}/\eta M^{1/6} = \psi(LM/T)$, where ρ_l is the density of the substance in the liquid state at its normal b.p., η is the viscosity coeff., L the latent heat of vaporisation, and ψ a common function for a group of related substances. Satisfactory agreement is obtained between calc. and observed vals. of η for He, Ne, A, Kr, Xe, Cl_2, Br, I, H_2, N_2, and O_2. H. J. E.

Viscosity of air, oxygen, and nitrogen. P. J. RIGDEN (Phil. Mag., 1938, [vii], **25**, 961—981; cf.

A., 1938, I, 131).—The η of air at 17° is $(1800{\cdot}7_6 \pm 0{\cdot}69) \times 10^{-7}$ c.g.s. [temp. coeff. $(4{\cdot}93 \pm 0{\cdot}11) \times 10^{-7}$ per degree]. The val. for N_2 at 17° is $(1738{\cdot}2 \pm 0{\cdot}7_3) \times 10^{-7}$ c.g.s. (temp. coeff. $4{\cdot}76 \times 10^{-7}$ per degree) and that for O_2 is $(2010{\cdot}5 \pm 0{\cdot}9) \times 10^{-7}$ c.g.s. (temp. coeff. $6{\cdot}23 \times 10^{-7}$ per degree). H. J. E.

Viscosity of mixtures of pyrrole with benzene, chlorobenzene, bromobenzene, and iodobenzene. M. Deželić (Bull. Soc. Chim. Yougoslav., 1937, 8, 139—143).—The composition–*d* and –η curves have been determined, at 20°. Compounds are apparently not formed. R. T.

Thermal properties of methyl chloride–mineral oil mixtures. A. Perlick (Z. ges. Kälte-Ind., 1936, **43**, 32—35; Chem. Zentr., 1936, ii, 516).—The v.p. of the mixtures decreases with rising η of the mineral oil. H. N. R.

Degree of depolarisation of scattered radiation from binary liquid mixtures. R. Kremann and E. Gastinger (Monatsh., 1938, **71**, 424—431).—The polarisation of light scattered by the mixtures C_6H_6–*n*-hexane, C_6H_6–$CHCl_3$, and $COMe_2$–$CHCl_3$, respectively, has been determined. The mol. constitution of the mixtures is discussed. E. S. H.

Intermetallic compounds produced by next nearest neighbour interaction in alloys. F. Bitter (J. Chem. Physics, 1938, **6**, 339—340).—Theoretical. W. R. A.

Order-disorder transformations in alloys. F. C. Nix and W. Shockley (Rev. Mod. Physics, 1938, **10**, 1—71).—A comprehensive review of published experimental and theoretical work. E. S. H.

Suggested intermetallic reaction in a liquid antimony-copper-tin-lead alloy. G. C. Seager and F. C. Thompson (Phil. Mag., 1938, [vii], **25**, 1104—1107).—Measurements of rate of cooling and of variation of resistivity with temp. strongly support the conclusion that the abnormality observed by Ellis (B., 1925, 809) is due to the incidence of solidification and not to an intermetallic reaction. T. H. G.

Critical solution temperatures of alcohols. L. A. Zepalova-Michailova (Sborn. Rabot Lab. Inst., 1937, **15**, 3—19).—Data are recorded for the systems (*a*) EtOH–di*iso*octyl, (*b*) Pr$^{\alpha}$OH–vaseline oil, and (*c*) Pr$^{\beta}$OH–vaseline oil. The effects of adding traces of H_2O to each system and of EtOH to (*b*) and (*c*) are shown. H_2O raises the crit. solution temp. of both Pr$^{\alpha}$OH and Pr$^{\beta}$OH considerably whilst EtOH has little effect. D. G.

Separation of phases in the water–phenol–*iso*butyl alcohol system. M. F. Talina and I. A. Malafeev (J. Phys. Chem. Russ., 1938, **11**, 270—273).—Equilibrium data at 40° and 70° are recorded and discussed. J. J. B.

Pressure of saturated vapour. J. K. Sirkin (J. Phys. Chem. Russ., 1938, **11**, 161—168).—The van der Waals equation for v.p. can be given the form $\log p = \log p_c + L/4{\cdot}57T_c - L/4{\cdot}57T$. An analogous expression is deduced for the v.p. over solid bodies. Both formulæ are in agreement with experimental data. J. J. B.

Solubilities of polythionates. II. Solubilities of sodium and ammonium polythionates. A. Kurtenacker and G. László (Z. anorg. Chem., 1938, **237**, 359—368).—*NH_4 pentathionate*, $(NH_4)_2S_5O_6$,$1{\cdot}5H_2O$, has been prepared. The solubilities of Na and NH_4 tri- and tetra-thionates have been measured at 0°, 20°, and 30°, and the 0° and 20° isotherms of the systems $Na_2S_3O_6$–$Na_2S_4O_6$–H_2O, $Na_2S_4O_6$–$Na_2S_5O_6$–H_2O, and $(NH_4)_2S_3O_6$–$(NH_4)_2S_4O_6$–H_2O have been determined. The only solid phases are the single salts. The NH_4 salts are anhyd.; Na tetra- and penta-thionates are present as dihydrates; $Na_2S_3O_6$ is present as trihydrate at 0° but the solid phase contains less H_2O at 20° and the transition point $3H_2O \rightarrow$ anhyd. is probably at or near this temp. F. J. G.

Solubility of iodine pentoxide in anhydrous hydrogen fluoride and the possible existence of "hydrofluorates" of iodine pentoxide. K. R. Webb (Proc. Leeds Phil. Soc., 1938, **3**, 477—480).—Experiments under various conditions, afford evidence of the solubility of I_2O_5 in anhyd. HF, and the probable formation of unstable compounds of the type I_2O_5,*x*HF by the spontaneous evaporation of such solutions at room temp. N. M. B.

Solubility of gold hydroxide in alkali and equilibria in the saturated solutions. H. L. Johnston and H. L. Leland (J. Amer. Chem. Soc., 1938, **60**, 1439—1445).—Data are recorded for 0—8N-NaOH. The solubility of $Au(OH)_3$ increases with increasing [NaOH] up to 0·42N, then falls rapidly to a min. at N-NaOH, and rises almost linearly as [NaOH] is further increased. The stable solid phase is $Au(OH)_3$ below 0·42N-NaOH, and Na_2HAuO_3 above 0·42N-NaOH. The ionic equilibria are discussed, and acid dissociation consts. for H_3AuO_3 are derived and compared with those for Cu and Ag hydroxides. A potentiometric method for the determination of Au is described. E. S. H.

Aqueous solubilities of isomeric hexanols. P. M. Ginnings and R. Webb (J. Amer. Chem. Soc., 1938, **60**, 1388—1389).—Data for methyldiethyl-, dimethyl*iso*propyl-, dimethyl-*n*-propyl-, methyl*tert.*-butyl-, ethyl*iso*propyl-, methyl*sec.*-butyl-, methyl-*iso*butyl-, ethyl-*n*-propyl-, methyl-*n*-butyl-, and *tert.*-amyl-carbinol at 20°, 25°, and 30° are recorded. The *tert.* isomerides are more sol. than the *sec.*, which are in turn more sol. than the most compact primary isomeride. Solubility is greatest when OH is in proximity to the centre of a compact mol., and decreases in each case with rise of temp. E. S. H.

Hydrogen bonds involving the C–H linking. Solubility of haloforms in donor solvents. G. F. Zellhoefer, M. J. Copley, and C. S. Marvel (J. Amer. Chem. Soc., 1938, **60**, 1337—1343).—The solubilities of MeCl, CH_2Cl_2, $CHCl_3$, CH_2ClF, $CHCl_2F$, $CHClF_2$, EtCl, CCl_3F, CCl_2F_2, $C_2Cl_3F_3$, and $C_2Cl_2F_4$ each in OEt·$[CH_2]_2$·O·$[CH_2]_2$·OAc, (OMe·$[CH_2]_2$·O·$[CH_2]_2)_2$O, and (OEt·$[CH_2]_2)_2$O, and of $CHCl_2F$ in 82 solvents (ethers, thioethers, esters, ether-esters, CO-compounds, bases, amides, hydrocarbons, fluorohydrocarbons, and $PhNO_2$) have been determined. The observed vals. exceed the "ideal"

solubility if the solute contains H and the solvent O (ether or ester) or basic N. The effect is in the order: $CH_3 < CH_2 < CH$, being greatest for $CHCl_3$. H bonds, O→H and N→H, are postulated in the interpretation of the results. R. S. C.

Unlimited solubility of metals in the solid state. N. AGEEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 65—68).—The view that a given cryst. structure is possible only if the electrons are able to arrange themselves in accordance with a definite energy distribution has been applied to a face-centred cube, and the conditions for the formation of a continuous series of solid solutions have been examined. N. M. B.

General problem in the theory of diffusion. B. HOSTINSKÝ (Compt. rend., 1938, **206**, 1452—1455).—Theoretical. A. J. E. W.

Diffusion of gold into gold. A. ZAGRUBSKI (Physikal. Z. Sovietunion, 1937, **12**, 118—119).—Radioactive Au, obtained by neutron bombardment, was placed in intimate contact with an ordinary Au sheet. The rate of diffusion was estimated by etching away the surface layers of the sheet and then measuring the radioactive residue. J. A. D.

Coefficient of self-diffusion of gold. A. M. ZAGRUBSKI (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1937, 903—913; cf. A., 1933, 561; 1937, I, 296).—Geiger counter measurements of the penetration of its radioactive isotope from a Au plate into electrolytically deposited Au layers give vals. at 800—1020° which can be represented by $D = 1{\cdot}36 \times 10^{4}e^{-53000/RT}$. The results accord with the formulæ of Langmuir and of Braune. I. McA.

Adsorption of gases by graphite. A. B. LAMB and E. N. OHL (J. Amer. Chem. Soc., 1938, **60**, 1287—1290).—Measurements of the adsorption of CO_2, H_2, and CCl_2F_2 on graphite and on activated C show that the adsorbed gas mols. do not enter the spaces between the basal planes of the graphite crystal, but are held at the external surface. The adsorption of H_2, He, and CS_2 by C produced by "explosion" of graphitic oxide has also been measured; although relatively large amounts are adsorbed, adsorption occurs only at the external surface. *X*-Ray diagrams show that the graphite structure is retained by this C, but that the average particle size is about 30 A., giving a greatly increased surface. Graphite obtained by heating SiC until the Si has evaporated shows poor adsorptive capacity. E. S. H.

Sorption of chlorine by activated charcoal. L. H. REYERSON and A. W. WISHART (J. Physical Chem., 1938, **42**, 679—685).—Adsorption isotherms of Cl_2 on steam-activated charcoal have been obtained at 35·5°, 51·0°, 73·5°, and 91·5°. The adsorption is about the same as that of Br (A., 1935, 696) but about 10 times that of I. The characteristics of the adsorption are very different from that on SiO_2 gel (A., 1937, I, 611). The min. surface area of the charcoal is $5{\cdot}54 \times 10^6$ cm.^{2} per g. J. W. S.

Theory of adsorption of vapours. S. J. PSCHESHEZKI (J. Phys. Chem. Russ., 1938, **11**, 205—212).—The adsorption isotherm of vapours is said to consist of two parts corresponding with the equations $a = bp^m$ and $a = C + B \log p$, respectively; b, m, C, and B are consts. The temp. variation of these consts. is calc. on the assumption of the invariability of the adsorption potential with the temp. J. J. B.

Determination of nature of binding in adsorption media. R. JUZA, R. LANGHEIM, and H. HAHN (Angew. Chem., 1938, **51**, 354—357).—Adsorption in the systems C–Br, SiO_2–Br, and C–O_2 has been studied by means of magnetic susceptibility measurements. The susceptibility of the adsorbed system is not an additive function of those of the components. The deviation from additivity decreases as successive amounts are adsorbed, indicating that the binding is weaker in the successive layers. E. S. H.

Adsorption of aliphatic amines and products of protein fission on aluminium oxide from aqueous solution. A. LOTTERMOSER and K. EDELMANN (Kolloid-Z., 1938, **83**, 262—278).—To serve as a basis for the possible separation of the hydrolysis products of proteins by chromatographic analysis, the adsorption isotherms of the most important of such products and of simpler related substances (NH_3, NH_4 salts, mono- and di-amines) have been determined. The best adsorbent is Al_2O_3 prepared by Brockmann's method. NH_3 is better adsorbed at low than at high p_H, and the adsorption of NH_4 salts is scarcely influenced by the valency of the anion. The hydrochlorides of primary, *sec.*, and *tert.* amines are adsorbed similarly, the adsorption increasing with the mol. wt. without being influenced by branching of the C chain. The homologous aminomonocarboxylic acids give normal isotherms, but the adsorbability decreases with increasing mol. wt. Among the dicarboxylic acids lysine dihydrochloride, tyrosine, and 3 : 5-di-iodotyrosine are not adsorbed at all and can thus be separated from all other products. The order of adsorption of the heterocyclic NH_2-acids is histidine > tryptophan > oxyproline > proline. F. L. U.

Surface tension of fused mixtures with a cryolite base. É. ELCHARDUS (Compt. rend., 1938, **206**, 1460—1462).—Vals. of γ for mixtures of cryolite, NaF or AlF_3, and Al_2O_3 are recorded. γ is decreased by addition of AlF_3, and increased by NaF; Al_2O_3 has a variable effect. In the neighbourhood of the m.p. γ increases with temp. owing to ionic dissociation, the γ–θ curves having the form required by theory (Onsager and Samaras, A., 1934, 1068). A. J. E. W.

Measurement of superficial electric moment in the interior of a liquid. (MLLE.) N. CHOUCROUN and M. ARDITI (Compt. rend., 1938, **206**, 1462—1464; cf. A., 1934, 1068).—A micro-electrophoresis apparatus for the observation of particles 1—2 mm. below the surface of the suspending liquid is described. Vals. of the superficial electric moment of particles of mastic and gamboge suspended in H_2O and 0·002N-HCl and -NaOH, and of the walls of the Pyrex and flint glass containing tubes, are recorded. The moments of the particles and tube walls are independent of each other. The surfaces are negatively charged in each case, the potential increasing with p_H. A. J. E. W.

Capillary systems. XIX (8). Permeability of coherent and compact material for gaseous and dissolved substances. E. MANEGOLD (Kolloid-Z., 1938, **83**, 299—319; cf. A., 1938, I, 355).—Data relating to liquid–liquid and liquid–gas interfaces and to plant cells are collected. F. L. U.

Theory of electrocapillarity. VII. Theory of surface films. S. R. CRAXFORD, O. GATTY, and T. TEORELL (Phil. Mag., 1938, [vii], **25**, 1041—1061).—Equations previously deduced (A., 1935, 698; 1936, 1196) are extended to surface films and applied to a typical and a simplified case, but existing data are insufficient to permit the use of precise equations. Boundary conditions are considered in relation to available data. The theory of two coexistent surface phases is discussed. A factor which contributes to the high capacities of specifically absorbed anions is suggested. Measurements of surface tension and chemical potential alone are insufficient to indicate the degree of dissociation of a compound in an interphase or surface film. T. H. G.

Viscosity of unimolecular films. D. G. DERVICHIAN and M. JOLY (Nature, 1938, **141**, 975; cf. A., 1937, I, 358).—The flow of surface monolayers $\propto$ the difference of pressure and inversely $\propto$ the length of the channel, but the dependence of flow on the width of the slit is complicated by entrainment of H_2O. L. S. T.

Pressure–area relations of monolayers at the solid–liquid interface. W. D. HARKINS and F. M. FOWKES (J. Amer. Chem. Soc., 1938, **60**, 1511—1512).—Pressure–area curves for monolayers of BuOH at H_2O–air, H_2O–solid paraffin, and H_2O–stibnite interfaces, and for AcOH at a H_2O–solid paraffin interface, show that the films are gaseous at low pressures. E. S. H.

Flow of unimolecular surface films. E. R. WASHBURN and H. R. R. WAKEHAM (J. Amer. Chem. Soc., 1938, **60**, 1294—1296).—The area of a unimol. stearic acid film which flows through a capillary increases with increasing applied film pressure, but the relation is not linear. For equal pressures, films on acid solutions flow more rapidly than films on neutral solutions. For equal pressures and $[H^+]$, films flow more rapidly at higher than at lower temp.; the temp. coeff. is greater at low than at high pressures. E. S. H.

Effect of *X*-rays on surface potentials of multilayers. F. J. NORTON and I. LANGMUIR (J. Amer. Chem. Soc., 1938, **60**, 1513).—The charging of *X* and *Y* multilayers of stearates by exposure to *X*-rays is described. E. S. H.

Activities of urease and pepsin monolayers. I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1938, **60**, 1351—1360).—The monolayers, spread on H_2O and then deposited on plates, or adsorbed from solution by conditioned plates, usually have high chemical activity. The activity of a urease layer, measured by the formation of NH_3 from $CO(NH_2)_2$ at p_H 7, disappears when deposited as an *A* layer on a surface conditioned with Na deoxycholate. Thus, the activity depends on the presence of hydrophobic groups in the surface. The activity of pepsin was tested by its power to clot skimmed milk. A substance in milk displaces adsorbed pepsin monolayers on the plate and allows the pepsin to diffuse into the solution in a completely active form. In many cases the sp. activity of the pepsin monolayers prepared from commercial pepsin was $\ll$ that of the original pepsin. E. S. H.

Investigation of thin layers of organic substances at the mercury/solution boundary by capacity measurements. I. High-molecular alcohols and acids. A. GORODETZKAJA and A. FRUMKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 639—643; cf. A., 1935, 298, 697; 1936, 1467).—With and without uni- and multi-mol. layers of cetyl alcohol (I), palmitic (II) and oleic acids (III), at the Hg/slightly acid N-Na_2SO_4 interface, measured vals. for the capacity of the electrical double layer are plotted against cathodic polarisation. For (I), a single const. min. capacity 1·03, decreasing on compression to 0·91 μF. per sq. cm., indicates a layer thickness *d* of 19 A. (the length of the mol.), using the formula $C = \epsilon/4\pi d$ for a surface condenser. For (II) and (III) two min. capacities are indicated; these decrease on compression as a result of the formation of unstable multilayers the nature of which has been corroborated in the case of (III) by interference methods. Calculation of *d* from capacities is unreliable for multi- (>3 mono-)layers owing to ionic penetration. I. McA.

Transition state in surface reactions. M. TEMKIN (J. Phys. Chem. Russ., 1938, **11**, 169—189).—A theory is advanced to explain the rates of gas adsorption and of heterogeneous reactions. The differences between this theory and that based on collision frequencies are pointed out. The views expressed are considered to afford a plausible interpretation of false equilibria. J. J. B.

Surface p_H. S. R. CRAXFORD, O. GATTY, and T. TEORELL (Phil. Mag., 1938, [vii], **25**, 1061—1066).—The usual definition of p_H is unsatisfactory when applied to interphases and surface films and two others are discussed, although measurements in terms of these are not directly possible. The consequences of these conclusions for many physicochemical and biological questions are very important. T. H. G.

Electrokinetic potential. II. Electrokinetic potential at the interfaces glass/ethyl alcohol–water and glass/acetone–water. K. KANAMARU, T. TAKADA, and K. AIKAWA (Kolloid-Z., 1938, **83**, 294—299).—These mixtures behave similarly to the dioxan–H_2O mixtures, in that the ζ-potential against glass is determined by the mol.-polarisation rather than by the difference of ϵ values. The ζ-potential can be expressed empirically by the formula $10^m(\epsilon - \epsilon_g)P^n$, where ϵ and ϵ_g refer to the liquid mixture and the glass respectively, *P* is the mol. polarisation of the mixture, and *m* and *n* are consts. which have nearly the same val. for all the systems studied. F. L. U.

Electrokinetics. XX. Interfacial energy and the molecular structure of organic compounds. VI. Electric moment of aliphatic alcohols, acids, and esters at cellulose and aluminium

oxide interfaces. M. A. LAUFFER and R. A. GORTNER (J. Physical Chem., 1938, **42**, 641—656; cf. A., 1933, 122).—The electric moment (μ) per sq. cm. of the double layer has been determined by the streaming potential method for aliphatic alcohols containing 1—7 C atoms at Al_2O_3 surfaces, and for fatty acids and esters at cellulose surfaces. In all cases the streaming potential $\propto$ pressure. The vals. of μ for alcohols on Al_2O_3 are about half as large as those on cellulose. Reversal of the sign of μ occurs between $Bu^{\alpha}OH$ and n-C_5H_{11}·OH at Al_2O_3 surfaces, and between EtOH and $Pr^{\alpha}OH$ at cellulose surfaces. In each case $Pr^{\beta}OH$ is opposite in sign to $Pr^{\alpha}OH$. Fatty acids at cellulose surfaces show reversal of sign between $EtCO_2H$ and $Pr^{\alpha}CO_2H$, but no reversal is shown on Al_2O_3. The vals. of μ are about one third of those on Al_2O_3. The variation with temp. of the conductivity and electrokinetic function of MeOAc in the diaphragm suggests that the effects observed are due to interaction of ions derived from the org. mols. of the liquids and the solid with which it is in contact. J. W. S.

Transfer of helium II on glass. J. G. DAUNT and K. MENDELSSOHN (Nature, 1938, **141**, 911—912).—Experiments with various arrangements of vessels indicate that the surface of a solid in contact with liquid He II is covered with a He film through which the liquid is transferred to the lowest available level; the rate of transfer increases rapidly with a fall in temp., and on glass is > on Cu. L. S. T.

Experiments with liquid helium II. A. K. KIKOIN and B. G. LASAREW (Nature, 1938, **141**, 912—913).—When a vac.-insulated glass tube, which can be heated electrically at the upper end, is partly immersed in liquid He II no heating effect becomes apparent in the upper part of the tube until a limiting current is reached. A film of liquid He II appears to be formed over the surface of the tube and heating begins only when this film evaporates at the limiting val. of the current. The calc. thickness of the film is $\sim 10^{-5}$ cm. L. S. T.

Transport phenomena in helium II. L. TISZA (Nature, 1938, **141**, 913).—An interpretation of the behaviour of He II on the assumption that its viscosity is due to the atoms in the "excited" state is discussed. A temp. gradient should arise during the flow of He II through a capillary. L. S. T.

Adhesion of particles of microscopic size. VIII. Adhesion of calcium carbonate particles in electrolyte solutions. A. VON BUZÁGH and K. DUX (Kolloid-Z., 1938, **83**, 279—287; cf. A., 1938, I, 358).—$CaCO_3$ particles behave similarly to those of $BaSO_4$ with respect to the influence of electrolytes on adhesion and on electrophoretic mobility. LiCl, NaCl, and KCl increase adhesion towards a const. val., and reduce but do not reverse the electrokinetic charge. Bi- and ter-valent cations at higher concns. reverse the charge and diminish adhesion. Specially marked effects are shown by $Ca^{\cdot\cdot}$, CO_3'', HCO_3', and OH'. F. L. U.

Influence of inorganic salts on the rotation of sucrose solutions. E. LANDT (Deut. Zuckerind., 1936, **61**, 377—378; Chem. Zentr., 1936, ii, 1888).—A primary dehydration effect with electrostatic deformation and complex formation is postulated. A. H. C.

Determination of crystallite size in metal and metal oxide smokes from *X*-ray and electron diffraction digrams and from electron microscope pictures. D. BEISCHER (Z. Elektrochem., 1938, **44**, 375—385).—The available methods are described, illustrated, and compared. The electron diffraction method is applicable only to particles <100 A. In the smokes examined no particles <10 A. were observed, and any particles of this size originally formed must increase rapidly either by aggregation or by the addition of metal atoms from the vapour phase. C. R. H.

Trajectory of ash particles in air and the determination of their size. K. PROSAD and D. N. SEN (Phil. Mag., 1938, [vii], **25**, 993—1003).—Photographs of the trajectory of a beam of cigar ash particles projected horizontally in air are used in determining the mean particle size (radius = $2{\cdot}34 \times 10^{-3}$ cm.). The particle size is shown to increase rapidly along the path. H. J. E.

Relationship between degree of depolarisation and particle properties in the scattering of light by colloids. W. LOTMAR (Helv. Chim. Acta, 1938, **21**, 792—812).—Mathematical. The influence of the size, shape, and concn. of particles on the degree of depolarisation of light scattered by colloidal solutions is discussed. J. W. S.

Electrochemical properties of mastic suspensions. R. AUDUBERT and G. CARPÉNI (J. Chim. phys., 1938, **35**, 115—128).—Aq. and alcoholic sols of mastic of varying particle size have been potentiometrically titrated using a glass electrode, and the data compared with data similarly obtained for the ultrafiltered sols. Differences are ascribed to acids on the surface of the mastic particles. In the case of small particles of diameter <1 μ. the electric charge can be ascribed principally to surface ionisation phenomena, but with increasing particle size the influence of surface ionisation diminishes. The data are discussed in reference to the electrochemical structure of the particle surface. C. R. H.

Titanium oxide hydrosols. Some relationships to oxide hydrosols of zirconium and thorium. H. S. OWENS and R. MORRIS (J. Physical Chem., 1938, **42**, 563—566; cf. A., 1935, 1459).—The p_H of TiO_2 hydrosols is raised by heating or by addition of K salts, the order of efficiency of which is $C_2O_4'' >$ tartrate $> SO_4'' > Cl'$. From the behaviour observed it is inferred that the sols are composed mainly of TiO_2 with few hydroxo or ol groups. The reaction with tartrate to form negatively charged micelles is attributed to chelation. J. W. S.

Electron microscope in colloid chemistry. D. BEISCHER and F. KRAUSE (Angew. Chem., 1938, **51**, 331—335; cf. A., 1938, I, 78).—Further examples of the application of the electron microscope to the study of colloidal systems are given. The systems described include ZnO, CdO, and lampblack, and membranes of colloidal Au in gelatin, collodion, V_2O_5, and rubber. F. L. U.

New results and problems in colloid investigation. P. A. THIESSEN (Angew. Chem., 1938, **51**, 318—324).—A review. F. L. U.

Dielectric behaviour of water in hydroxides, basic hydrates, and oxides of iron, beryllium, and magnesium. O. GLEMSER (Z. Elektrochem., 1938, **44**, 341—353).—The dependence on temp. of the dielectric const., ϵ, of suspensions in paraffin oil has been investigated. As expected, for compounds containing combined H_2O, ϵ increases linearly with decrease in temp., no discontinuity being observed at 0°. For hydrated Fe_2O_3 gels of various ages, ϵ decreases with decrease in temp., but the absence of discontinuity indicates that the H_2O is not simply adsorbed. H_2O is considered to be retained in capillaries of such small dimensions that its v.p. and, therefore, f.p. are reduced. No discontinuity was detected above −60°. C. R. H.

Gel water in skeleton structures and macrocrystals. D. BALAREV (Kolloid-Z., 1938, **83**, 319—321; cf. A., 1935, 447).—The v.p. of H_2O enmeshed in pptd. $BaSO_4$ and in NH_4Cl crystallised from solutions containing $CoCl_2$ and $FeCl_3$ has been measured during dehydration and rehydration. Curves are obtained resembling those given by typical gels. The results are interpreted in the light of the author's theory. F. L. U.

Silica jellies. I. Gelation time and change in p_H value as functions of concentration, initial p_H value, and temperature. H. W. BATCHELOR (J. Physical Chem., 1938, **42**, 575—585).—The times of gelation and p_H changes during gelation observed are expressed in three-dimensional diagrams. With decreasing temp. min. gelation times at const. concn. are found to be associated with the progressively higher p_H vals. J. W. S.

De-emulsification. E. NAGELSTEIN (Kolloid-Z., 1938, **83**, 324).—The presence of air entrapped in emulsions contributes markedly to their instability. This factor is of greater importance than the dissolution of alkali from the glass container, suggested by Cheesman and King (A., 1938, I, 310). F. L. U.

Comparative study of transparency and particle number in the coagulation of As_2S_3 sols. K. HOFFMANN and H. A. WANNOW (Kolloid-Z., 1938, **83**, 258—262; cf. A., 1937, I, 564).—During coagulation of As_2S_3 sols by KCl, $MgCl_2$, and $LaCl_3$, the transparency to light and the particle concn. decrease in such a manner that similar curves are obtained when these two quantities are plotted against the activity coeff. of the added cation. Divergence occurs in the later stages owing to differences in the structure of the aggregates, which with KCl are large and loosely packed and with $LaCl_3$ small and compact. Approx. agreement with Rayleigh's theory is found only in the early stages when the particles are small. F. L. U.

Protective action and sensitisation. H. R. KRUYT and C. W. HORSTING (Rec. trav. chim., 1938, **57**, 737—740).—At low concns. Na arabate (I) (from gum arabic and NaOAc) and starch sensitise AgI sols, whilst at higher concns. they exert a protective action. Changes in flocculation vals. for KNO_3, $Ba(NO_3)_2$, and $Ce(NO_3)_3$ after addition of (I) are discussed. The nature of the flocculation process is considered. W. R. A.

Mechanism of the development of the isoelectric zone in gelatin gels submitted to electrolysis. II. J. SWYNGEDAUW (Compt. rend. Soc. Biol., 1938, **128**, 199—202; cf. A., 1938, III, 234).—The development of the isoelectric zone is due to the prevention of infiltration of the products of electrolysis by a process of electrofiltration, whilst a $[H^·]$ of $10^{-4·7}$ allows the passage of current through a zone freed from ions combined with the gelatin. H. G. R.

Flow potentials, electro-osmosis, and electrophoresis with platinum. H. R. KRUYT and J. OOSTERMAN (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 370—374).—No electro-osmotic transfer is observed when a p.d. of 180 v. is applied across a porous plug of Pt-black or Pt-sponge. These and similar negative results with flow potentials (A., 1937, I, 415) are contrasted with the electrophoretic transfer of particles in Pt sols (Bredig). Consideration of the disposition of the lines of electric force provides a satisfactory explanation in all three cases. Pt sols in 10^{-4}N-HCl are unstable and exhibit a low mobility which, however, is increased, and the sols are rendered stable, by the addition of 0·1% of quinhydrone. F. L. U.

Migration of adrenaline in an electrical field. G. SANKARAN and S. RANGANATHAN (Indian J. med. Res., 1937, **25**, 81—83).—The migration of adrenaline was studied after exposure to a const. electric field for 24 hr. in buffer solutions of p_H 1·15—12·4. Adrenaline migrated to the electro-negative pole in acid or slightly alkaline, and to the electro-positive in strongly alkaline, solutions. H. B. C.

Physical chemistry of the proteins. XIV. Solvent action of sodium chloride on carboxyhæmoglobin in 25 and 35% ethyl alcohol at −5°. R. M. FERRY, E. J. COHN, and E. S. NEWMAN (J. Amer. Chem. Soc., 1938, **60**, 1480—1486; cf. A., 1937, I, 134).—The solubility of horse carboxyhæmoglobin in EtOH–H_2O containing NaCl at ionic strengths 0·01—0·2 has been determined. Activity coeffs. have been derived from the solubility ratios and compared with vals. calc. on the basis of Kirkwood's theory, assuming hæmoglobin to be a double dipole with a moment of 500×10^{-18} e.s.u. Effects due to electric moments of higher order and to salting-out have also been considered. E. S. H.

Variations in electric charge of proteins submitted to the action of proteolytic enzymes. II. Pepsin. III. J. LOISELEUR (Ann. Ferm., 1938, **4**, 220—241).—Addition of pepsin to a protein solution causes an immediate fall in ζ-potential, due to fixation of pepsin on dissociated protein groups. The fall is never complete, some groups remaining free, but the rapidity of hydrolysis is determined by the extent of the fall. With rapid hydrolysis ζ quickly returns to its initial val., but with slow hydrolysis the initial val. is reached only after a considerable interval. It thus appears that fixation precedes hydrolysis, and that stabilisation of ζ in the course of the reaction

represents an equilibrium between fixation of protein groups and the liberation of new dissociated groups. I. A. P.

Presentation of the fundamentals of thermodynamics. W. E. ROSEVEARE (J. Chem. Educ., 1938, **15**, 214—217). L. S. T.

Temperature variation of diffusion processes. H. S. TAYLOR (J. Chem. Physics, 1938, **6**, 331—334).—Eyring's concept of holes in liquids and his theory of abs. reaction rates, which suggest that diffusion coeffs. should vary exponentially with temp., are borne out by existing data. Liquids containing H bonds have high activation energies of diffusion. The conclusion that small diffusing mols. should not show a const. diffusion–viscosity product appears to be confirmed. W. R. A.

Free energy and entropy of nitrosyl chloride. F. P. JAHN (J. Chem. Physics, 1938, **6**, 335—338).—From electron diffraction and mol. spectral data the experimental measurements of the NOCl dissociation equilibrium may be checked. Vals. of the free energy function, $(G^\circ - U_0^\circ)/T$, and the entropy, S°, are calc. for the ideal gas from 298·1° to 1000° K. at 50° intervals. The electronic wt. is 4 and by comparison with equilibrium data for $2NOCl \rightleftharpoons 2NO + Cl_2$ ΔU_0° is 15,510±53 g.-cal. From this the equilibrium consts. for the reaction at 50° intervals between 450° and 750° are computed and compared with recorded experimental vals. W. R. A.

Thermodynamic functions of the chloro- and bromo-methanes, formaldehyde, and phosgene. D. P. STEVENSON and J. Y. BEACH (J. Chem. Physics, 1938, **6**, 341).—Errata (cf. A., 1938, I, 185). W. R. A.

Water-gas equilibrium. G. MEYER and F. E. C. SCHEFFER (Rec. trav. chim., 1938, **57**, 604—608).—Using an apparatus previously described (A., 1935, 583) the equilibrium $CO_2 + H_2 \rightleftharpoons CO + H_2O$ has been investigated. The vals. of the equilibrium const. agree with those previously derived indirectly from the reactions $Sn + 2H_2O \rightleftharpoons SnO_2 + 2H_2$ and $Sn + 2CO_2 \rightleftharpoons SnO_2 + 2CO$. W. R. A.

Present status of the thermodynamics of electrolytic solutions. H. S. HARNED (J. Franklin Inst., 1938, **225**, 623—659).—A lecture. Activity coeffs. of strong electrolytes, calc. from e.m.f., f.p., b.p., and v.p. measurements, relative partial molal heat contents deduced from heats of dilution and e.m.f. data, and relative partial molal heat capacities, deduced from calorimetric and e.m.f. data, are compared. The ionic activity product of H_2O and the energy relations in the combination of $H^\cdot$ and OH' under various conditions and as deduced by various methods are discussed. The thermodynamics of solutions of electrolytes in a mixture of H_2O and other solvents, and the extrapolation of activity coeffs. to saturated solutions, are also considered. J. W. S.

Development of a theory of solutions (binary systems) on the basis of solution forces, and the test of the results against experiment. K. FREDENHAGEN (Z. physikal. Chem., 1938, **B**, **40**, 51—107).—The limitations of the van 't Hoff and Planck methods of dealing with the problem of the v.p. of binary mixtures are reviewed. A general theory is developed which envisages the possibility of reaction between the two components with formation of a compound. Various binary systems of inorg. and org. compounds, and binary metallic systems, in which compound formation may occur, are discussed. H. J. E.

Solubility and activity coefficients of barium *p*-iodobenzenesulphonate in solutions of strong electrolytes. J. SIRUCEK (J. Chim. phys., 1938, **35**, 136—142).—The solubility at 20° has been determined in H_2O and in solutions of KNO_3, KCl, $MgCl_2$, and $LaCl_3$. 100 g. of H_2O dissolve 0·8589 g. of the salt and in presence of electrolyte the solubility increases with increasing electrolyte concn. Activity coeffs. have been calc. by two methods, with concordant results. The mean val. for the radius of the sphere of influence of the ions is 4—6 A. C. R. H.

F.p. of concentrated aqueous solutions of urea, urethane, and acetamide. H. M. CHADWELL and F. W. POLITI (J. Amer. Chem. Soc., 1938, **60**, 1291—1293).—Data are recorded for a wide range of concn. "Preliminary" activity coeffs. have been calc. All the solutions show positive deviations from Raoult's law, which increase in the order NH_2Ac, $CO(NH_2)_2$, urethane. E. S. H.

Concentration of hydrogen ions in aqueous solutions of complex cobaltammines and their absorption spectra. IV. Aqueous solutions containing the ethylenediamine molecule. T. UÉMURA and N. HIRASAWA (Bull. Chem. Soc. Japan, 1938, **13**, 377—387).—The absorption curves for $[CoX_3]Cl_3,H_2O$, $[CoX_2Cl(H_2O)]Cl_2$ (I), $[CoX_2(H_2O)]Cl_3$ (II), $[CoX_2Cl_2]Cl$ (III), $[CoX_2OH(H_2O)]Cl_2,H_2O$ (IV), $[CoX_2OH(H_2O)]Br_2$ (V), and $[CoX_2NO_2(H_2O)](NO_3)_2$ [X = $(CH_2\cdot NH_2)_2$] are recorded. Variations in p_H have only a slight effect on the form of the curves. There is no difference between the curves of the *cis* and *trans* forms in the case of (II), (III), and (V). The cations of (I), (II), and (III) are stable in acid solutions but form the cation of (IV) in alkaline solutions. C. R. H.

First dissociation constant of ethyl- and phenyl-substituted succinic acids. H. HARTMAN (Rec. trav. chim., 1938, **57**, 697—702).—The following vals. (× 10^{-5}) are recorded for the first dissociation consts. at 25°: monoethyl-, 8·3; diethyl-, 14·4 (*as*), 34·1 (racemic), 23·2 (*anti*); triethyl-, 183; phenyl-, 16·5; diphenyl-, 26·5 (racemic), 33·0 (*anti*), -succinic acid. W. R. A.

Ultra-violet absorption spectra and dissociation constants of the ene-diol-α-ketonic compounds reductone and reductic, *l*-ascorbic, and *d*-glucoascorbic acids. G. CARPÉNI (Compt. rend., 1938, **206**, 1571—1573; cf. A., 1937, 1, 462; 1938, 1, 226; II, 147).—The change of position of the absorption maxima of these compounds with p_H has been investigated. The vals. of pK_2 for reductone and redndtic acid, deduced from these measurements, are ~12·8 and 12·9, respectively. The relations shown by the acidic properties of the four compounds confirm the lactone structure for the ascorbic acids. A. J. E. W.

Acid–base function in non-aqueous media. I. Autoprotolytic constant of *m*-cresol. II. Relative strengths of acids in chlorobenzene. D. C. GRIFFITHS (J.C.S., 1938, 815—818, 818—823).—I. From measurements of the e.m.f. of the cell $H_2|0{\cdot}01$M-$PhSO_3H|0{\cdot}01$M-piperidine$|H_2$, both solutions being in a 0·1M solution of *iso*amylamine benzenesulphonate in *m*-cresol, it is deduced that the autoprotolytic const. of the ionisation of *m*-cresol ($[C_6H_4Me{\cdot}OH_2^{\cdot}][C_6H_4Me{\cdot}O^{\prime}]$) is $10^{-14{\cdot}66}$ and $10^{-14{\cdot}41}$ at 23° and 19°, respectively.

II. From measurements of the intensities of colour in solutions of 2 : 6-$C_6H_3(NO_2)_2{\cdot}OH$ or of bromophenol-blue in PhCl, to which various quantities of NH_2Bu^{β} and org. acids are added, so as to yield series of solutions of const. salt concn. and total acid concn., it is shown that the relative strengths of $EtCO_2H$, AcOH, BzOH, *m*-$OH{\cdot}C_6H_4{\cdot}CO_2H$, $CH_2Cl{\cdot}CO_2H$, $CHCl_2{\cdot}CO_2H$, and $CCl_3{\cdot}CO_2H$ follow closely those in H_2O. J. W. S.

Osmotic pressure, heat of dilution, and entropy of dilution in the systems cellulose nitrate–*cyclo*hexanone and cellulose nitrate–acetone. C. G. BOISSONNAS and K. H. MEYER (Z. physikal. Chem., 1938, **B**, **40**, 108—114).—An equation is derived from which the entropy of dilution and the heat of dilution can be calc. from the temp.-dependence of the osmotic pressure. Vals. of the differential molar entropies and heats of dilution for the system cellulose nitrate–*cyclo*hexanone are given and an error in a previous calculation for the system cellulose nitrate–$COMe_2$ (cf. A., 1937, I, 563) is indicated. H. J. E.

Mixtures of ampholytes. A. BOUTARIC (Ann. Soc. Sci. Bruxelles, 1938, **58**, 154—160).—The mutual pptn. of ampholytes at vals. of $[H^{\cdot}]$ falling between those which correspond with the isoelectric points of the individual ampholytes has been examined in reference to the law of mass action. Max. precipitability occurs when $[H^{\cdot}] = Z$, given by $2[k_ak_a^{\prime}k_w^2 - k_bk_b^{\prime}Z^4] - Z[k_w(k_b + k_b^{\prime})Z^2 - k_w^2(k_a + k_a^{\prime})] = 0$, or approx. by $Z = \sqrt{[k_w(k_a + k_a^{\prime})/(k_b + k_b^{\prime})]}$ in which k_a, k_b, $k_a^{\prime}$, $k_b^{\prime}$ are the acidic and basic dissociation consts. of the two ampholytes. P. W. R.

Acute tin pest. II. E. COHEN and W. A. T. COHEN-DE MEESTER (Proc. K. Akad. Wetensch., Amsterdam, 1938, **41**, 462—467; cf. B., 1938, 175).—The acceleration of the $\beta \rightarrow \alpha$ change in Sn, produced by alloying with a little Al, does not occur when special precautions are taken to prevent access of traces of H_2O. The acceleration observed under ordinary conditions is due to deformation of the Sn lattice by reaction of the alloy with H_2O. E. S. H.

Thermodynamic study of the cadmium–antimony system. H. SELTZ and B. J. DEWITT (J. Amer. Chem. Soc., 1938, **60**, 1305—1308).—The activities and relative partial mol. heat contents of Cd and Sb in their liquid alloys have been derived from e.m.f. measurements of the cells $Cd(l)|CdCl_2 + LiCl + KCl(l)|Cd$ (in Cd–Sb liquid solutions). The heat of fusion of CdSb is 8270 g.-cal. per mol. The heat and free energy of formation of CdSb and of Cd_3Sb_2 have been calc. The entropy of Cd_3Sb_2 at 298·1° K. is 78·9 e.u. E. S. H.

Two-component system sulphur dioxide and potassium iodide. I. MORI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 342—354; cf. A., 1931, 799).—The v.p.–concn. relation is considered in reference to data for solutions of KI in liquid SO_2 at 0°, 10°, and 20°. The mol. compound formed between −10° and 0° is claimed to be $KI,2SO_2$. Thermodynamic quantities are calc. I. McA.

Binary systems containing arsenic trichloride and 5-chloro-5 : 10-dihydrophenarsazine.—See A., 1938, II, 299.

Vapour–liquid equilibrium. I. Apparatus for the study of systems with volatile components. G. SCATCHARD, C. L. RAYMOND, and H. H. GILMANN. **II. Chloroform–ethyl alcohol mixtures at 35°, 45°, and 55°.** G. SCATCHARD and C. L. RAYMOND (J. Amer. Chem. Soc., 1938, **60**, 1275—1278, 1278—1287).—I. Apparatus and technique are described.

II. Vapour and liquid compositions and equilibrium pressures have been determined. Application of the Gibbs–Duhem equation shows deviations from the perfect gas laws somewhat > those calc. from the theory of corresponding states. The excess chemical potentials, free energy, heat content, and entropy of mixing have been calc.; the last two pass through a max. and min. An explanation of the behaviour of the system, based on attraction between the mols. under certain conditions of orientation, is put forward. E. S. H.

Binary systems of camphoric acid with acetanilide and acetmethylanilide. D. PONTE (Boll. Chim. farm., 1938, **77**, 285—287).—Camphoric acid forms eutectic mixtures with NHPhAc and NHPhMeAc which contain 44 and 45% of acid and melt at 88° and 32°, respectively. F. O. H.

Glyceryl trinitrate and ethylene glycol dinitrate. J. D. BRANDNER (Ind. Eng. Chem., 1938, **30**, 681—684).—The v.p. of the two esters at 10—50° and of their mixtures at 40—50° have been determined. The v.p. of the trinitrate is very small, being approx. 1% of that of the dinitrate. The two esters form ideal binary mixtures. F. O. H.

Dissociation pressures of $BaCl_2,2H_2O$ and $BaCl_2,2D_2O$. M. HOMMA and T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 331—337).—Data corresponding with $BaCl_2,2X_2O \rightleftharpoons BaCl_2,X_2O + X_2O$ (X = H, D) over the range 25—55° agree with the respective equations : $\log p = 10{\cdot}813 - 2995{\cdot}8/T$, $\log p = 11{\cdot}135 - 3102{\cdot}5/T$. Heats of hydration are given. I. McA.

Vapour pressure measurements on the three-phase equilibria of the system, sodium bromide–water. P. DINGEMANS (Rec. trav. chim., 1938, **57**, 703—709).—The transition point for the dehydration of $NaBr,2H_2O$ is 50·60° and is lowered 0·40° for each 1 wt.-% of NaCl present as impurity. The v.p. data cover the range 10—100°. The heat of hydration of NaBr at 18° is 4660 g.-cal. W. R. A.

Equilibria in the system potassium sulphate–magnesium sulphate–calcium sulphate–water at 100°. J. E. CONLEY, A. GABRIEL, and E. P. PARTRIDGE (J. Physical Chem., 1938, **42**, 587—616).—

Part of this system has been studied at 100° and regions of stability are defined tentatively for the solid phases: K_2SO_4; $CaSO_4,H_2O$; $K_2SO_4,5CaSO_4,H_2O$; $K_2SO_4,MgSO_4,2CaSO_4,2H_2O$ (I); $CaSO_4$. Equilibria in this system are often incomplete after 60 days, and metastable equilibria are frequently observed. The results are applied to the problem of extracting K_2SO_4 from (I). J. W. S.

Equilibrium between carbon, molten iron, and a gas containing carbon monoxide and dioxide. G. PHRAGMÉN (Jernkont. Ann., 1936, **120**, 184—189; Chem. Zentr., 1936, ii, 2006). L. S. T.

Determination of heat capacity by means of refractive index. M. M. SAMIGIN (J. Phys. Chem. Russ., 1938, **11**, 228—230).—In the empirical equation $C_p = a[R] + b$ the consts. a and b are characteristic for every homologous series of org. compounds. J. J. B.

Heats of dilution and heat contents of aqueous cadmium sulphate solutions. T. H. DUNKELBERGER and A. L. ROBINSON (J. Amer. Chem. Soc., 1938, **60**, 1301—1305).—Intermediate heats of dilution have been determined over the range 0·8—0·0001M at 10°, 15°, and 20°, and extrapolated to infinite dilution to obtain integral vals. No definite approach to the Debye–Hückel limiting law is indicated at the lowest concns. measured. Relative partial mol. heat contents and heat capacities have been calc. and compared with published vals. derived from e.m.f. measurements. E. S. H.

Heat capacities, entropies, and heats of dissolution of anhydrous sodium sulphate and of sodium sulphate decahydrate. Application of the third law of thermodynamics to hydrated crystals. K. S. PITZER and L. V. COULTER (J. Amer. Chem. Soc., 1938, **60**, 1310—1313).—Heat capacities from 14° to 300° K. are recorded. Heats of dissolution in H_2O at 25° are: Na_2SO_4 −560±10, $Na_2SO_4,10H_2O$ 18,840 g.-cal. per mol. The entropies of the salts have been calc. The entropy of $Na_2SO_4,10H_2O$, calc. from the entropy of H_2O vapour and dissociation pressure of the hydrate together with the heats of dissolution and the entropy of Na_2SO_4, is 1·7 g.-cal. per degree > that calc. from the lower temp. heat capacities, suggesting the presence of false thermal equilibrium at low temp. This effect is ascribed to the random distribution of protons forming H linkings. The entropy of SO_4'', calc. from the above data, is 4·4±1 g.-cal. per degree. E. S. H.

Integral free energies of dissolution of Na_2SO_4 and K_2SO_4. T. TAKAI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 338—341; cf. A., 1936, 937).—Vals. have been calc. from the differential free energies of dissolution (known) and dilution (derived from v.p. data). I. McA.

Heats of mixing of haloforms and polyethylene glycol ethers. G. F. ZELLHOEFER and M. J. COPLEY (J. Amer. Chem. Soc., 1938, **60**, 1343—1345).—The heats of mixing of $CHCl_3$ and of $CHCl_2F$ with $(OMe·CH_2)_2$ and $OMe·[CH_2·CH_2·O]_4·Me$, respectively, have been determined. The high vals. obtained are ascribed to complex formation, which occurs to the extent of 30—40%. The association is caused by the tendency to form a C–H←O linking. The positions of the max. on the curves indicate that, due to steric hindrance, it is only the alternate O atoms which are available for linking. E. S. H.

Heats of mixing of ternary systems. V. FISCHER (Ann. Physik, 1938, [v], **32**, 347—352).—Curves are given for EtOH–MeOH–H_2O mixtures. L. G. G.

Heat of combustion of isoprene. R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, **20**, 589—597).—At 25° and 760 mm. the heat of combustion of liquid isoprene is 3156·9±1·6 kilo-joules per g.-mol. On the basis of a previously reported val. of the heat of combustion of rubber hydrocarbon, the heat evolved in the reaction $x C_5H_8$ (liq.) = $(C_5H_8)_x$ is found to be $(74·8±6·2)x$. Corresponding figures for gaseous isoprene are 3182·8±1·7 and $(100·7±6·3)x$. D. F. R.

Thermal data. X. Heats of combustion and free energies at 25° of organic compounds concerned in carbohydrate metabolism. H. M. HUFFMAN and S. W. FOX (J. Amer. Chem. Soc., 1938, **60**, 1400—1403).—Heats of combustion and free energies of formation (in parentheses) recorded are: fumaric acid −194·88 (−157·23), maleic acid −189·45 (−151·32), succinic acid (−179·36), α-*d*-glucose −305·73 (−218·72), α-*d*-glucose hydrate −376·52 (−275·76), β-*d*-glucose (−218·32) kg.-cal. E. S. H.

Conductance of aqueous solutions of electrolytes. D. A. MACINNES (J. Franklin Inst., 1938, **225**, 661—686).—A lecture. The factors involved and the assumptions made in the Debye–Hückel and Onsager theories of conductivity are detailed. Proofs of the validity of the Onsager equation, for strong electrolytes at low concn. and its extension to weak electrolytes and to conc. solutions are discussed. J. W. S.

Computation of ionisation constants and limiting conductance values from conductivity measurements. T. SHEDLOVSKY (J. Franklin Inst., 1938, **225**, 739—743).—The change in equiv. conductivity (Λ) with equiv. concn. (C) for $C \leqq 0·01$ can be expressed by $1/\Lambda = 1/\Lambda_0 + (\alpha\Lambda_0 + \beta)\sqrt{C}/\Lambda_0^2$ (α and β are consts.). This relation is in accord with modern theory of conductivity and is valid over a greater concn. range than the Onsager equation. The modification of this relation in the computation of dissociation consts. of weak electrolytes is discussed. J. W. S

Solutions of electrolytes in non-aqueous solvents. C. A. KRAUS (J. Franklin Inst., 1938, **225**, 687—707).—A lecture. The influence of various properties of the solute and solvent on the conductivities of these solutions is discussed. J. W. S.

Ionic dissociation of sodium triphenylmethyl. E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, **60**, 1403—1406).—The conductances of dil. solutions of CPh_3Na in Et_2O have been measured; the calc. ionisation const. is $1·5 \times 10^{-12}$. The revised val. for the electron affinity of CPh_3 is −48±5 kg.-cal. E. S. H.

Behaviour of complex ions in strong electric fields. H. DIEKMANN (Ann. Physik, 1938, [v], **32**,

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378—392).—The conductivities of aq. solutions of cetylpyridinium chloride, and H_2O–glycerol solutions of $MgSO_4$ have been measured with a.c. up to about 300 kv. per cm. The behaviour of the complex ions is conditioned by the Wien effect and the "separation" effect (cf. Malsch and Hartley, A., 1935, 37). The order of magnitude of these effects is obtained from dependence of the relations on the temp. and concn. L. G. G.

Electrolytic water transport and ionic hydration numbers. H. C. HEPBURN (Phil. Mag., 1938, [vii], **25**, 1074—1096).—It is claimed that the most consistent results for the hydration of ions in aq. solution have been obtained from methods based on the transport of H_2O during electrolysis; of these the most convenient is the measurement of vol. changes in a cell incorporating a parchment-paper membrane. A sensitive form of apparatus for this purpose is described and an accurate expression for the electrolytic H_2O transport developed. Measurements have been made on NaCl and results previously obtained for $CuSO_4$ and $CuCl_2$ have been recalc. The true transport and hydration nos. for these ions have been deduced and the ionic complexity of $CuCl_2$ solution is discussed. T. H. G.

Mechanism of the hydrogen electrode. G. OKAMOTO (J. Fac. Sci. Hokkaido Imp. Univ., 1937, III, **2**, 115—182).—An amplification of work previously published (A., 1936, 1346). The no. of active centres on a Ni electrode where the reaction $H_2 \rightleftharpoons 2H$ can occur is calc. from the temp. coeff. of isotopic interchange between H and D, and from that of the anodic current, to be $2—4 \times 10^{12}$ per cm.^{2} F. L. U.

Normal potential of cadmium and radius of the cadmium ion in solutions of [cadmium] benzenesulphonate. (MLLE.) M. QUINTIN (Compt. rend., 1938, **206**, 1564—1566; cf. A., 1938, I, 254, 367).—Vals. of $E_0' = E_{Cd} + (RT/2F)\log c$, corr. for hydrolysis at high dilutions, are calc., assuming a linear relation between E_{Cd} and log c. For vals. of f_+ given by the Gronwall–La Mer–Greiff formula for an ionic radius of 6·2 A., a val. of E_0 (0·3436 v.) is obtained which is const. over the concn. range studied. A. J. E. W.

Form of the Henderson diffusion potential formula. A. AIROLA (Svensk Kem. Tidskr., 1938, **50**, 128—129; cf. A., 1937, I, 520).—An expression for the diffusion potential between two dil. solutions of uni-univalent electrolytes in terms of l_1, l_2, c_1, and c_2 gives results in good agreement with experiment. M. H. M. A.

Electromotive force of saturated Weston standard cells containing deuterium oxide. L. H. BRICKWEDDE and G. W. VINAL (J. Res. Nat. Bur. Stand., 1938, **20**, 599—605).—Measurements have been made with standard Weston cells containing up to about 6% of D_2O. Const. and reproducible results were obtained. The D_2O causes a decrease in e.m.f. amounting to 2·9 μv. per g.-mol. %. No change in the temp. coeff. can be detected. Hysteresis is slightly less for cells containing added D_2O. D. F. R.

Helmholtz and Nernst [equations for the e.m.f. of concentration cells]. W. D. BANCROFT (J. Physical Chem., 1938, **42**, 687—691).—Nernst's equations for the e.m.f. of concn. cells coincide with those of Helmholtz only at infinite dilution, and, since the latter are thermodynamically sound, the Nernst equations can be applied only at very low concn. The Helmholtz equations involve the change of v.p. with concn., and hence the e.m.f. depends on the concn. of undissociated salt, base, or acid. The equations hold accurately for the Pb accumulator and for cells of the type $Zn|ZnCl_2$ (c_1), Hg_2Cl_2 (sat.)$|Hg|Hg_2Cl_2$ (sat.), $ZnCl_2$ (c_2)$|Zn$ to high concns. Measurements of the p_H of biological solutions are inaccurate to an unknown extent. J. W. S.

[Cell] combinations of silver with platinum and nickel in aqueous potassium iodide, and their electrostatic character. (MLLE.) S. VEIL (Compt. rend., 1938, **206**, 1625—1627).—The variation of the e.m.f. E of the cell Ag–KI aq. (c)–Pt with c is in agreement with the relation previously found for the cell $Cu–CuCl_2–Pt$ (A., 1938, I, 143), viz., $\log[(E - E_{H_2O})/(E_\sigma - E_{H_2O})] \propto \log(c/\sigma)$ (E_{H_2O} and E_σ represent the vals. of E for $c = 0$ and saturation, respectively). This shows that the relation is not dependent on one electrode being in contact with its own ions. Ag is positive with respect to Ni in aq. $NiSO_4$ or NH_3, but the polarity is reversed in aq. KI, indicating that the relative Volta polarities of two metals may vary in different solutions. A. J. E. W.

Theory of the electrolytic double layer and of the potential-determining ionic adsorption. J. KASPAR (Helv. Chim. Acta, 1938, **21**, 650—663).—Theoretical. The adsorption theory of the double layer is developed in a generalised form and relations between the potential-determining ionic adsorption and the structure of the double layer are indicated. J. W. S.

Redox potentials of complex iron salts with the sodium salts of organic acids. W. REINDERS and (MISS) C. H. DE MINJER (Rec. trav. chim., 1938, **57**, 594—603).—The redox potential of a $FeSO_4$–$Fe_2(SO_4)_3$ solution decreases progressively as increasing amounts of a neutral alkali salt of a polybasic or OH-acid are added. Such solutions have great buffer capacity against oxidation or reduction. Vals. obtained on addition of Na salts of $H_2C_2O_4$, malonic, tartaric, citric, and lactic acids have been determined potentiometrically. The influence of addition of H_2SO_4 and NaOH on the buffered solutions is discussed. Complex ferric ions are formed with citric, $Fe_2(C_6H_5O_7)_3'''$, malonic, $Fe(C_3H_2O_4)_3'''$, and oxalic acids, and $Fe(C_2O_4)_3'''$. W. R. A.

Oxidation–reduction potential of the system *d*-alanine $\rightleftharpoons$ ammonium pyruvate. R. WURMSER and S. FILITTI-WURMSER (Compt. rend. Soc. Biol., 1938, **128**, 133—135).—The vals. obtained for E_0 at 37° are −0·066 v. and −0·048 v. at p_H 7·3 and 7·0, respectively. The calc. val. at 25° is −0·040 v. H. G. R.

Value of diffusion currents observed during electrolysis by means of the dropping mercury

electrode. Polarographic study. D. ILKOVIC (J. Chim. phys., 1938, **35**, 129—135).—Mathematical. C. R. H.

Measurements of the ionisation constant of benzoic acid using silver chloride electrodes. H. T. BRISCOE and J. S. PEAKE (J. Physical Chem., 1938, **42**, 637—640).—From measurements of the e.m.f. of cells of the typo $H_2|BzOH(m_1),NaOBz(m_2),NaCl(m_3)|AgCl,Ag$ it is deduced that the dissociation const. of BzOH at 25° is $6{\cdot}05 \times 10^{-5}$. J. W. S.

Acidity measurements with the hydrogen electrode in mixtures of acetic acid and acetic anhydride. J. RUSSELL and A. E. CAMERON (J. Amer. Chem. Soc., 1938, **60**, 1345—1348).—H_2SO_4, $HClO_4$, and certain sulphonic acids show increased acidity in the presence of Ac_2O, which is not accounted for by dehydration. With H_2SO_4 the effect is ascribed to the formation of $AcSO_3{\cdot}OH$, which undergoes rearrangement to $OH{\cdot}SO_2{\cdot}CH_2{\cdot}CO_2H$. Attention is directed to the significance of this effect in investigations of the influence of $H^{\cdot}$ activity on acetylation reaction rates. E. S. H.

Comparative study of some complex bases. (MLLE.) J. BRIGANDO (Compt. rend., 1938, **206**, 1467—1469).—The potentiometric and conductometric titration curves of $[CoX_3](OH)_3$ [$X = (NH_3)_2$, $(CH_2{\cdot}NH_2)_2$ (I), $C_3H_6(NH_2)_2$] with HCl are identical, showing that the strengths of the complex bases are independent of the amine forming the complex ion; curves for the titration of aq. NH_3 and (I) with HCl are not identical, and are different from those given by the complex bases. The continuous absorption of the latter in the ultra-violet shows an abrupt decrease on passing the neutral point; with (I) the absorption spectrum changes progressively with addition of HCl. A. J. E. W.

Irreversibility of photographic development in elon solutions containing sodium sulphite. A. E. CAMERON (J. Physical Chem., 1938, **42**, 629—635; cf. A., 1938, I, 314).—Strips of film have been exposed for various times, given standard development, rinsed in 1% AcOH, washed and dried, and then immersed for 15·5 hr. in solutions containing *p*-$NHMe{\cdot}C_6H_4{\cdot}OH$ (I) 8 g., KBr 8 g., and Na_2SO_3 6·25 g. per l., and of varying p_H, agitated by air or N_2. Development continues only at $p_H > 5{\cdot}0$, but at lower p_H there is no reduction in the intensity of the image. The potential of a Pt wire in this solution is −0·050 v. Tenfold increase in the $[Na_2SO_3]$ does not affect this min. p_H val. for development, but it is reduced to 4·8 by fivefold increase in the concn. of (I). Changes in the electrode potential during contact with the film are attributed to changes in the $[Ag^{\cdot}]$. None of the potentials observed accords with the val. −0·150 v. found for *p*-$NH_2{\cdot}C_6H_4{\cdot}OH$ solutions at the reversal point (A., 1937, I, 471). It is concluded that no reversible oxidation-reduction system exists in solutions of (I) and Na_2SO_3. J. W. S.

A new phenomenon of an electrical nature and a new effect shown by metals. G. PICCARDI (Gazzetta, 1938, **68**, 246—263).—Contact with a dielectric such as glass, which has been polarised electrostatically by various means, induces a change in certain physical and chemical properties of H_2O and other polar liquids. These changes are not perfectly elastic and may persist for an appreciable time after contact with the polarised dielectric has ceased, and they may be induced across various kinds of diaphragms. With metallic diaphragms a new type of effect is produced. Changes in the behaviour of H_2O in biological processes can also be induced by contact with a dielectric in the above manner. O. J. W.

Motor-electric effect. J. KASPAR (Helv. Chim. Acta, 1938, **21**, 733—747).—The so-called motor-electric effect is shown to comprise an electro-kinetic transverse effect, due to disturbance of the double layer at the electrode–solution interface, and a convection effect due to disturbance of diffusion layers in the solution. The second effect can be eliminated in systems in true electro-chemical equilibrium, a condition attainable in reasonable time only with a metal in contact with a solution of its ion. In the case of Ag–$Ag^{\cdot}$ ion systems no electro-kinetic effect could be observed during the relative movement of the phases. J. W. S.

Chemical reaction considered as an intramolecular diffusion phenomenon. III. Calculation of absolute reaction rates by means of the diffusion hypothesis and quantum theory. J. A. CHRISTIANSEN (Z. physikal. Chem., 1938, **B**, **40**, 183—196; cf. A., 1938, I, 35).—Theoretical. The diffusion hypothesis is applied in the special case of quasi-elastic binding to the numerical calculation of reaction velocity as a function of temp. H. J. E.

Kinetics of the explosive reaction between hydrogen and oxygen sensitised by nitrogen peroxide. R. J. W. NORRISH (J. Amer. Chem. Soc., 1938, **60**, 1513).—Polemical (cf. A., 1937, I, 621). E. S. H.

Kinetics of the decomposition reactions of the lower paraffins. I. *n*-Butane. E. W. R. STEACHIE and I. E. PUDDINGTON (Canad. J. Res., 1938, **16**, **B**, 176—193).—The kinetics of the thermal decomp. of *n*-butane have been studied for pressures 5—60 mm. and temp. 513—572°. An expression is given for the first-order reaction coeffs., which agree with the results of Frey and Hepp, but differ from those of Paul and Marek. Chain processes appear to be involved since the rate of reaction falls rapidly with diminishing pressure and the first-order coeffs. also fall rapidly as the reaction proceeds. The reaction products are H_2, CH_4, C_3H_6, C_2H_4, and C_2H_6 and are independent of temp. and pressure over the range covered. The reaction mechanism is discussed and compared with that of other paraffin decomps. T. H. G.

Extinction of propylene flames by diluting with nitrogen and carbon dioxide: explosive properties of propylene. G. W. JONES and R. E. KENNEDY (U.S. Bur. Mines, Rept. Invest. 3395, 1938, 14 pp.).—14 vols. of N_2 or 7·7 vols. of CO_2 must be added to each vol. of C_3H_6 to make all mixtures with air non-inflammable. Inflammability limit curves and tables which have been constructed show

that the added inert gas has little effect in raising the lower limit of inflammability except at high concns. of inert gas, but that the lowering of the upper limit is almost directly ∝ the amount of added inert gas. The max. excess pressure developed by igniting C_3H_6–air mixtures is 94 lb. per sq. in., and is obtained with mixtures containing 4·90—5·28% of C_3H_6. The ignition temp. of C_3H_6–air and C_3H_6–O_2 mixtures decreases with increasing $[C_3H_6]$, the ignition temp. for a given C_3H_6–O_2 mixture being < that for a similar C_3H_6–air mixture. C. R. H.

Influence of the pressure value on the velocity of flame propagation under constant pressure, with uniform conditions, in mixtures of propane and town gas with air. G. RIBAUD and H. GAUDRY (Compt. rend., 1938, **206**, 1648—1649).—Velocities of propagation (v) (17—56 cm. per sec. in a 9-mm. tube) for 3—6% C_3H_8–air mixtures at 1—11 kg. per sq. cm. pressure (p) are recorded; v decreases with increasing p. Reproducible results could not be obtained with a 20% town gas–air mixture, but for p = 1—11 kg. per sq. cm., v is const. (1 m. per sec.) within ±20%. A. J. E. W.

Kinetics in ionic systems. V. K. LA MER (J. Franklin Inst., 1938, **225**, 709—737).—A lecture. The Brönsted theory of reaction kinetics in ionic systems, and its subsequent development, are discussed. J. W. S.

Kinetics of oxidation of iodide by chlorate ion in presence of catalysts. K. WEBER, F. LISZT, and I. BALZER (Arh. Hemiju, 1938, **12**, 12—22).—The velocity of the reaction $KClO_3 + 6KI + 3H_2O \rightarrow KCl + 6KOH + 6I$ has been determined, in presence of excess of KI and HCl, and with $VOSO_4$ catalyst. The temp. coeff. is 2·87 for the interval 25—35°. PhOH and *p*-nitrophenol do not affect the reaction, whilst *m*- and *p*-$C_6H_4(OH)_2$ inhibit it; this is ascribed to their oxidation by $KClO_3$, the effective concn. of which is thus lowered. $MnSO_4$ and $NiSO_4$ retard the reaction, and are regarded as negative catalysts. R. T.

Comparison of the rates of hydrolysis of methyl, ethyl, *iso*propyl, and *tert.*-butyl bromides in acetone. Water catalysis in such reactions. W. TAYLOR (J.C.S., 1938, 840—842).—The second-order hydrolysis velocity coeffs. are Me > Et < Pr^{β} ⟨⟨⟨ Bu^{γ} for reactions in $COMe_2$ containing 5% and 10% of H_2O. The data can be explained satisfactorily by assuming that the hydrolysis is bimol., and that the min. at Et is due to the decreasing facility of attack of the α-C by the OH of the reagent H_2O mol., together with concurrently increasing facility of attack of the halogen of the alkyl halide by the H of the H_2O down the series Me, Et, Pr^{β}, Bu^{γ}. The catalytic influence of H_2O is due to the dissociating effect of H_2O on the hydroxylic reagent R·OH, where R may be H, alkyl, or acyl, *i.e.*, $(R{\cdot}OH)_n \rightleftharpoons nR{\cdot}OH$. In other words, H_2O can catalyse the reaction by bringing about dissociation of the H_2O already in solution in the org. solvent. C. R. H.

Kinetics of two ionic exchange reactions of the methyl halides in water. E. A. MOELWYN-HUGHES (J.C.S., 1938, 779—784).—The replacements of Br in MeBr by I and of I in MeI by Br have been studied in aq. solution and over a range of temp. Although complicated by hydrolysis of the halides, the reactions have been shown to be bimol. and each reaction is opposed by the other. The velocity coeffs. for the two reactions, k_2 and k_4, respectively, give vals. agreeing with the empirical relations $k_2 = 1{\cdot}68 \times 10^{10} \times e^{-18,260/RT}$, $k_4 = 6{\cdot}02 \times 10^9 \times e^{-19,310/RT}$, and $k_2/k_4 = 2{\cdot}79 \times e^{-1050/RT}$. C. R. H.

Rates of hydrolysis and extinction coefficients of halogeno-fatty acids in the quartz-glass ultra-violet. A. KAILAN and F. KUNZE (Monatsh., 1938, **71**, 373—423).—The rates of hydrolysis under ultra-violet radiation at 10° of aq. mono-, di-, and tri-chloro-, mono-, di-, and tri-bromo-, mono- and di-iodo-acetic acids, α- and β-chloro-, α-bromo-, αβ-dibromo-, and α-iodo-propionic acids, and $CHCl_3$ have been determined. The quantum yields have been evaluated, and the extinction coeffs. measured at different λ. Below certain concns., which have been determined for each substance, the rate of hydrolysis in a quartz flask is almost independent of concn. At higher concns. the rate increases with increasing no. of substituent halogen atoms and in the order Cl<Br<I, with the exception of $CH_2I{\cdot}CO_2H$, which hydrolyses slowly and gives the smallest quantum yield. The greatest rate of hydrolysis is given by $CBr_3{\cdot}CO_2H$. All the acids yield small amounts of CO_2. No relation between quantum yield and absorption was found. E. S. H.

Velocity of the Cannizzaro reaction. J. J. BLANKSMA and W. H. ZAAIJER (Rec. trav. chim., 1938, **57**, 727—728).—The velocity of the Cannizzaro reaction at 100° in 50% MeOH under the influence of $Ba(OH)_2$, $Sr(OH)_2$, and $Ca(OH)_2$ has been studied. HCO_2H is formed in detectable amounts. The reaction rates with $Ba(OH)_2$ and $Sr(OH)_2$ are of the same order. In 50% EtOH the reaction with $Ba(OH)_2$ is faster than in 50% MeOH but reduction of PhCHO is more evident. No appreciable alteration in velocity results from variation in the H_2O content of the alcohol; the reactions with $Ba(OH)_2$ in 40% and 50% MeOH have the same velocities. The reaction is faster with alkaline earth hydroxides than with alkali hydroxides (A., 1937, II, 195). MeOH is a better solvent than EtOH because with the latter MeCHO is formed and is readily converted into a resin. W. R. A.

Unsaturated sulphones. III. Measurement of the velocity of oxidation by peracetic acid. E. DE R. VAN ZUYDEWIJN (Rec. trav. chim., 1938, **57**, 806—810).—The velocity of oxidation of sulphones is very slow and secondary reactions cause the results to be irreproducible; factors responsible for this are discussed. W. R. A.

Influence of directing groups on nuclear reactivity in oriented aromatic substitutions. V. Dilatometric investigation of the kinetics of aromatic nitration especially in nitromethane solution. G. A. BENFORD and C. K. INGOLD (J.C.S., 1938, 929—955).—Previous work on dilatometry and on nitration kinetics is reviewed. A general dilatometric method has been developed for studying aromatic nitration. The nitrations of C_6H_6,

PhMe, and PhEt in $MeNO_2$ solution are zero-order reactions and are retarded by HNO_2 without disturbing the zero-order law. The abs. rates of nitration are equal under the same conditions with regard to temp., $[HNO_3]$, and $[HNO_2]$. The effective reaction order for the nitration of the halogen-substituted benzenes is >0 and <1, and invariably rises during the course of the reaction. In these reactions also, HNO_2 retards nitration. The data are discussed theoretically and a series of chain reactions is formulated which explains the data, the fundamental sequence of chain initiation, propagation, and destruction being $MeNO_2 \rightarrow CH_2{:}NO{\cdot}OH$ (catalysed by HNO_3); $CH_2{:}NO{\cdot}OH + HNO_3 \rightarrow CH_2{:}NO{\cdot}ONO_2 + H_2O$; $CH_2{:}NO{\cdot}ONO_2 + ArH \rightarrow CH_2{:}NO{\cdot}OH + ArNO_2$ (ArH is the compound nitrated); and finally $CH_2{:}NO{\cdot}OH \rightarrow MeNO_2$ (catalysed by HNO_3) or some reaction between $CH_2{:}NO{\cdot}OH$ and NO or NO_2. C. R. H.

Kinetics of nitration of 1-nitroanthraquinone.—See A., 1938, II, 286.

Liquid-phase reactions at high pressures. III. Esterification of acetic acid. S. P'ENG, R. H. SAPIRO, R. P. LINSTEAD, and D. M. NEWITT (J.C.S., 1938, 784—791).—For pressures >4000 atm., the rate of esterification of AcOH between 70° and 80° increases with increase in pressure. The increase becomes less on ascending the series of primary alcohols and is greater for *iso*- and *sec.*-alcohols than for primary alcohols. For a given pressure the velocity coeffs. for the primary alcohols are of the same order. The activation energy, E, and the const., A, of the Arrhenius equation ($k = Ae^{-E/RT}$) increase with pressure, the vals. for E for the primary alcohols increasing progressively on ascending the series at all pressures. The vals. of A are discussed with reference to collision frequency, it being shown that increase in A with pressure can, in certain cases, be accounted for by increase in collision frequency. A linear relation exists between E and $\log A$. C. R. H.

Experiments with heavy water on the acid hydrolysis of esters and the alkaline decomposition of diacetone alcohol. W. E. NELSON and J. A. V. BUTLER (J.C.S., 1938, 957—962).—The velocity of hydrolysis of HCO_2Et and MeOAc in H(D)Cl solutions increases with increasing D content of the solution, the shapes of the velocity-[D] curves being in reasonable agreement with calc. curves, indicating that the medium is in thermodynamic equilibrium with a complex, probably $R{\cdot}CO_2(H^{\cdot}){\cdot}R'$, and that the reaction is not subject to general acid catalysis. Data for the rate of decomp. of diacetone alcohol (I) in NaOH(D) solutions favour the view that the reaction does not proceed by way of an equilibrium complex, but the differences between observed and calc. curves are too small to be conclusive. Since the transfer of $D^{\cdot}$ from (I) to OH' or OD' is slower than the corresponding transfer of $H^{\cdot}$, "heavy" (I) reacts more slowly than "light" (I), and since the rate of transfer of $H^{\cdot}$ to OD' is more rapid than to OH', "light" (I) reacts more quickly in D_2O than in H_2O. The enolisation of the terminal $COMe_2$ is not catalysed by acids because the O is already in OH form. C. R. H.

Activation energy of organic reactions. I. Electronic theories of organic chemistry from the standpoint of chemical kinetics. C. N. HINSHELWOOD, K. J. LAIDLER, and E. W. TIMM. **II. Formation of quaternary ammonium salts.** K. J. LAIDLER and C. N. HINSHELWOOD. **III. Kinetics of acid hydrolysis of esters.** E. W. TIMM and C. N. HINSHELWOOD (J.C.S., 1938, 848—858, 858—862, 862—869).—I. An attempt is made to correlate certain aspects of the electronic theory of org. reactions with the modern analysis of activation energy. Changes of reactivity resulting from electronic displacements as a result of substitution are primarily due to changes in activation energy, which can be regarded as being made up of two parts, the energy required to overcome the repulsion of the approaching reagent, and that required to weaken the existing bond. The conclusions which follow from a theoretical consideration of the balance between these two kinds of energy are applied to available experimental data.

II. The rate of quaternary salt formation between NEt_3 or C_5H_5N and MeI or $Pr^{\beta}I$ in C_6H_6 and $PhNO_2$ has been investigated. Activation energies, E, were determined from data at four temp. The observed changes in E are discussed with reference to the authors' theory.

III. The acid hydrolysis of EtOAc and the three chloroacetates in aq. EtOH, of nine substituted Et benzoates in aq. EtOH and aq. $COMe_2$, and of three substituted Me benzoates in aq. MeOH has been investigated, and the data have been compared with data for alkaline hydrolysis. The order of the *p*-substituents in their effect on the val. of E is OMe> Me>H>halogen>NO_2. E is higher in acid than in alkaline hydrolysis and the effect of the substituents is smaller. The effect of the solvent is opposite to that observed in alkaline hydrolysis. The change in reactivity due to substitution and to change of solvent is discussed on the basis of the author's theory C. R. H.

Nitration of the halogeno-benzenes.—See A., 1938, II, 313.

Reaction between *tert.*-butyl chloride and hydrolytic solvents.—See A., 1938, II, 304.

Heterogeneous reactions of the type $A_{solid} + B_{gas} = C_{solid}$. III. Experimental detection of the elementary steps of the composite process. J. ZAWADZKI and S. BRETSZNAJDER (Z. physikal. Chem., 1938, **B**, **40**, 158—182; cf. A., 1933, 911).—Data on solid–gas reactions are reviewed, with special reference to hysteresis phenomena. The rôles of activated and normal adsorption and of lattice changes as rate-determining processes are discussed for the case of the reaction of metallic oxides with CO_2 and SO_3. H. J. E.

Mechanism of corrosion of metals which decompose water. E. PLANK and A. URMÁNCZY (Z. anorg. Chem., 1938, **238**, 51—64).—Measurements of the velocity of dissolution of Tl in aq. HCl, H_2SO_4, and HNO_3, respectively, at different concns. and 25° support Urmánczy's theory of the mechanism (cf. A., 1938, I, 257, 316). The influence of stirring on the velocity of dissolution, ϕ, in 0·26N-HNO_3 is given by

$\phi = A + B\sqrt{N} + C\sqrt[3]{N}$, where N is the no. of revolutions per min. and A, B, and C are consts. E. S. H.

Velocity of dissolution of lead in acids. IV. G. TEDESCHI (Gazzetta, 1938, **68**, 157—166; cf. A., 1938, I, 257).—The relation $V = Ka^2$ is derived, where V = velocity of dissolution of a metal in an acid, K = a const., and a = activity of the acid anions. This expression is confirmed by data for the dissolution of Pb in HCl and in H_2SO_4, and of Al in HCl. Theories of the dissolution of metals in acids are discussed. O. J. W.

Thermal dissociation of ferric oxide. F. MEUNIER and O. L. BIHET (Congr. Chim. ind. Bruxelles, 1935, **15**, II, 944—951; Chem. Zentr., 1936, ii, 1874).—This has been investigated by the streaming method of Kleffner and Kohlmeyer (A., 1933, 40). The loss in wt. of the Fe_2O_3 increases with temp. and with the quantity of the N_2 passed over the Fe_2O_3, but owing to a back-diffusion of the liberated O_2, never reaches the max. val. of 3·33% required for the formation of pure Fe_3O_4. The introduction of metallic Ni prevents this back-diffusion. The thermal dissociation of Fe_2O_3 begins at 600°, but proceeds very slowly at temp. <1000°; above 1200°, velocities are very high. Dissociation proceeds in the stages $Fe_2O_3 \rightleftharpoons$ saturated solution of Fe_3O_4 in Fe_2O_3 (I) + O_2; (I) $\rightleftharpoons$ saturated solution of Fe_2O_3 in Fe_3O_4 (II) + O_2; and (II) $\rightleftharpoons$ $Fe_3O_4 + O_2$. L. S. T.

Relation between rates of general basic catalysis in different reactions. H. L. PFLUGER (J. Amer. Chem. Soc., 1938, **60**, 1513—1514).—A straight line is obtained when the catalytic consts. for the mutarotation of glucose at 18° are plotted logarithmically against the corresponding catalytic consts. for the decomp. of nitramide at 15°, both in aq. solution. E. S. H.

Reactions in concentrated sulphuric acid. III. Combinations of two and three catalysts in combustion of carbon monoxide. J. MILBAUER (Chem. Obzor, 1936, **11**, 1—6; Chem. Zentr., 1936, ii, 1904).—The oxidation of CO in conc. H_2SO_4 at 237° in presence of SeO_2, As_2O_3, As_2O_5, Pd, Ag_2SO_4, $HgSO_4$, $CuSO_4$, V, Sn, and combinations of these is described. A. H. C.

Induced oxidation of iodobenzene during the oxidation of benzaldehyde in an atmosphere of oxygen. W. P. JORISSEN and (MISS) A. C. B. DEKKING (Rec. trav. chim., 1938, **57**, 829—833).—PhCHO on oxidation in O_2 yields BzO_2H. The oxidation of PhI by BzO_2H yields iodoxybenzene. The reaction between PhI, PhCHO, and O_2 has been studied manometrically and in $CHCl_3$ and $COMe_2$. Induced oxidation of PhI occurs, the products being the mono- and di-benzoates of iodosobenzene. W. R. A.

Function of a catalyst. S. KOMATSU and K. MITSUI (Rec. trav. chim., 1938, **57**, 586—590).—The catalytic reduction of styrene and COPhMe by Ni, Cu, Zn, Al, Mg, and anhyd. $CuCl_2$, $ZnCl_2$, $MgCl_2$, and $AlCl_3$ has been investigated. A qual. relation appears to exist between the catalytic activity of chlorides towards reduction of the C:C and C:O groups and their halochromy. W. R. A.

Form assumed by manganese dioxide used as a catalyst in the dry decomposition of potassium chlorate. G. DENIGÈS (Bull. Trav. Soc. Pharm. Bordeaux, 1936, **74**, 93—112; Chem. Zentr., 1936, ii, 1875—1876).—Spectrograms reveal the formation of a permanganate when MnO_2 is used as a catalyst in the decomp. of $KClO_3$. The free acid is not formed, as other investigations show it to be no longer stable at the temp. required for the catalytic decomp. of $KClO_3$. Mn_2O_7, also, is not formed. $KMnO_4$ may be produced, but only in small amounts which are considered to be not responsible for the catalytic action of MnO_2. Solid $KMnO_4$ dissolves in molten $KClO_3$ without any sign of decomp. at temp. > those at which the addition of MnO_2 brings about visible and energetic evolution of O_2. It is assumed that $Mn(MnO_4)_2$ is formed as an intermediate product in the decomp. of $KClO_3$. This, and the regeneration of MnO_2, are represented by $9MnO_2 + 2KClO_3 = 3[(MnO_4)_2Mn] + 2KCl$ and $3[(MnO_4)_2Mn] = 9MnO_2 + 3O_2$. L. S. T.

Catalytic toxicity and chemical structure. IV. Relative toxicity of simple phosphorus, arsenic, antimony, and bismuth compounds. E. B. MAXTED and A. MARSDEN (J.C.S., 1938, 839—840).—The poisoning, by hydrides, of a Pt catalyst during the hydrogenation of crotonic acid has been investigated. The relative toxicity per g.-atom of poison increases in the order P = As < Sb < Bi. C. R. H.

Supposed activation of hydrogen bromide by oxygen. Y. URUSHIBARA and O. SIMAMURA (Bull. Chem. Soc. Japan, 1938, **13**, 407).—In absence of O_2 and light reduced Ni and HBr do not react, but in presence of O_2 $NiBr_2$ and H_2 only are formed, the O_2 apparently activating the HBr. C. R. H.

Addition of hydrogen bromide to undecenoic acid in toluene. II. Influence of anti-oxidants on the actions of oxygen and reduced nickel. Y. URUSHIBARA and M. TAKEBAYASHI (Bull. Chem. Soc. Japan, 1938, **13**, 404—406).—HBr and pure undecenoic acid, in the dark, in PhMe at 0° for 1 hr., give in presence of (*a*) air or (*b*) reduced Ni, 97 and 34% yields of the 11-bromoundecoic acid, respectively. $NHPh_2$, *o*- and *p*-$C_6H_4(OH)_2$ reduce the yields in (*a*) to 65, 6, and 3%, and in (*b*) to 31, 8, and 10%, respectively. The weak inhibiting effect of $NHPh_2$ on the action of O_2 is explained (cf. Ashton and Smith, A., 1934, 631). A. T. P.

Addition of hydrogen bromide to allyl bromide in presence of various substances. VII. Effect of nickel filings, and influence of anti-oxidants on the actions of oxygen and reduced nickel. Y. URUSHIBARA and M. TAKEBAYASHI (Bull. Chem. Soc. Japan, 1938, **13**, 400—404; cf. A., 1937, II, 270).—CH_2:$CH{\cdot}CH_2Br$ and HBr react in the dark at 12—15° for 3 days in presence of O_2, reduced Ni, or Ni filings, to give 96, 91, and 68% yields of $CH_2(CH_2Br)_2$ (I), respectively. Addition of $NHPh_2$, and *o*- and *p*-$C_6H_4(OH)_2$ diminishes the yields of (I) to 9, 9, and 7% in presence of O_2, and to 81, 12, and 20%, respect-

ively, in presence of reduced Ni (cf. Kharasch and Mayo, A., 1933, 805). A. T. P.

Catalytic formation of methane from carbon monoxide and hydrogen. IV. Specific nature of the accelerating influence on nickel catalysts in the reaction between water vapour and equal volumes of carbon monoxide and hydrogen. K. M. CHAKRAVARTY (Z. anorg. Chem., 1938, **237**, 381—387).—In mixtures of CO, H_2, and H_2O, the presence of Th, Ce, or Al oxides in Ni-sugar charcoal catalysts favours the reactions $C + H_2O \rightleftharpoons CO + H_2$ and $C + 2H_2O \rightleftharpoons CO_2 + 2H_2$, whereas the presence of K_2CO_3 favours the reaction $2CO \rightleftharpoons C + CO_2$. A Ni catalyst containing ThO_2 and CeO_2 (99 : 1) but no C is effective for the reactions $CO + H_2O \rightleftharpoons CO_2 + H_2$ and $2CO + 2H_2 \rightleftharpoons CH_4 + CO_2$. F. J. G.

Catalytic activity of aqueous tungsten trioxide suspensions. F. REIFF and R. NEUMANN (Z. anorg. Chem., 1938, **238**, 103—112).—The accelerating influence on the inversion of sucrose depends on the relative amounts of molecularly dissolved, colloidally dissolved, and suspended WO_3, which contribute 1%, 50—67%, and 34—50%, respectively. Catalysis traced to colloidal WO_3 is independent of $[NH_3]$, but that due to suspended WO_3 varies with $[NH_3]$, reaching a max. at 1%. E. S. H.

Catalytic oxidation of hydrocarbons in the vapour phase.—See B., 1938, 762.

Catalytic polymerisation of ethylene.—See B., 1938, 762.

Catalysis in hydrocarbon chemistry.—See B., 1938, 754.

Stability of butadiene in presence of Lebedev's catalyst.—See B., 1938, 762.

Progress of polarisation of the nickel anode in the electrolysis of water in alkaline solutions. G. GRUBE and A. VOGT (Z. Elektrochem., 1938, **44**, 353—360).—When alkaline solutions are electrolysed with a Ni anode and an Fe cathode O_2 formation at the anode brings about an increase of terminal voltage accompanied by formation at the anode of a brown layer consisting of a solid solution of NiO_2 in Ni_2O_3 (cf. Foerster, A., 1908, ii, 146). Ni is not considered to be completely passive, traces passing into solution forming $Ni(OH)_2$, which is oxidised at the anode to a higher oxide which facilitates O_2 liberation. C. R. H.

Electrolytic preparation and properties of iron phosphide, PFe. J. L. ANDRIEUX and M. CHÊNE (Compt. rend., 1938, **206**, 1562—1563; cf. A., 1934, 964).—PFe has been prepared by electrolysis at 850—900° of mixtures of HPO_3 or $NaPO_3$ with Fe_2O_3 or $FeCl_2$, with or without added NaF. The electrolysis is carried out in a C crucible, used as cathode, with a C or Fe anode, using 15—25 amp. at 4—5 v. PFe crystallises in steel-grey feebly magnetic needles, ρ 6·0. It resists atm. oxidation at 100°, and the action of NaOH, Na_2CO_3, KNO_3, Na_2O_2, HNO_3, and HCl; it is attacked by boiling conc. H_2SO_4, aqua regia, and alkali persulphates. A. J. E. W.

Preparation of thin layers of thorium and actinium by electrolysis in ethyl alcohol. (MME.) S. COTELLE and M. HAÏSSINSKY (Compt. rend., 1938, **206**, 1644—1646).—Uniform coherent deposits containing Th are formed on electrolysis of an EtOH solution of $Th(NO_3)_4$ (3—5 mg. per c.c.) containing 15—25% $COMe_2$, using a Ag or Pt cathode and a c.d. of 1—2 ma. per sq. cm. Similar deposits containing Ac are obtained using a mixture of La and meso-Th-2 nitrates; meso-Th-2 may also be deposited without La by using $NaNO_3$ instead of $La(NO_3)_3$ in the meso-Th separation. A. J. E. W.

Electrolytic oxidation.—See B., 1938, 807.

Rochelle salt copper plating bath. III. Anode behaviour. IV. Current efficiencies.—See B., 1938, 803.

Anodic behaviour in cyanide copper-plating baths.—See B., 1938, 803.

Oxide films on rustless steels and anomalies in their use as cathode materials.—See B., 1938, 803.

Chromium plating with special reference to black chromium.—See B., 1938, 803.

Anodic corrosion of commercial manganese during electrolysis.—See B., 1938, 804.

Catalytic decomposition of cassiterite-containing tin ores by cathodal reduction.—See B., 1938, 807.

Behaviour of lead anodes in a [zinc] sulphate electrolyte. Influence of cobalt salts.—See B., 1938, 807.

Electrolysis of potassium alkyl phthalates.—See A., 1938, II, 325.

Chemical actions of hydrogen excited by electrodeless discharge. H. NAGAOKA and T. MISHIMA (Proc. Imp. Acad. Tokyo, 1938, **14**, 128—133).—The action of at. H on various salts has been examined spectroscopically; the spectra are characteristic of the elements forming the salts. A correllation between the spattering or non-spattering of the metal, produced by reduction, and the heat of formation of the salt is suggested. Certain salts exhibited a characteristic fluorescence. W. R. A.

Chemical action of electrical discharges. XVI. Production of hydrogen cyanide by the electric arc, at various frequencies, in mixtures of hydrocarbon vapours, nitrogen, and hydrogen. E. BRINER, J. DESBAILLETS, and M. WERTHEIM (Helv. Chim. Acta, 1938, **21**, 859—862; cf. A., 1938, I, 150).—Mixtures of C_6H_{14} or C_8H_{18} with N_2 and H_2 give better yields of HCN on passage through a high-frequency arc than do CH_4–N_2–H_2 mixtures, in accord with the energetics of the reactions. With C_8H_{18} the yield may exceed 60 g. of HCN per kw.-hr. More soot is deposited on the electrodes with the higher homologues, especially with ββδ-trimethylpentane. The deposit contains only traces of compounds containing H and N, these probably being held by adsorption. J. W. S.

Photolysis of gaseous hydrogen suphide. G. S. FORBES, J. E. CLINE, and B. C. BRADSHAW (J. Amer. Chem. Soc., 1938, **60**, 1431—1436).—H_2S and HBr were photolysed successively, under identical

conditions, using λ 208 mμ., in a rotating quartz cell. Assuming that 1 quantum produces 1 mol. of H_2 from HBr at 400 mm., the quantum yield of H_2S, referred to that of HBr, is $1{\cdot}02 \pm 0{\cdot}05$ mols. of H_2 per quantum. Systematic errors are cancelled by this comparison. The quantum yield is independent of pressure (8—1400 mm.) and of light flux over a 14-fold range. Correlation of these results with published work indicates that, when α particles act on H_2, 4·2 H atoms are produced per ion pair. E. S. H.

Bromination of acetylene in light of the wavelengths 546 and 436 mμ. K. L. MÜLLER and H. J. SCHUMACHER (Z. physikal. Chem., 1938, **B**, **39**, 352—370).—The reaction was studied at 60—120°, with C_2H_2 pressures of 15—160 mm., and Br pressures of 15—80 mm. The rate is given by $d[C_2H_2Br_2]/dt = k[I_{abs.}][C_2H_2][Br_2]/([Br_2] + k')$. The rate is increased by increasing the total pressure up to 600 mm. by additions of N_2, CO_2, He, or $C_2H_2Br_2$. Further increase in total pressure has no influence. The temp. coeff. is slightly <1, but depends on concn. The quantum yield was 4×10^4 mols. per *hν*. The reaction scheme of Rollefson involving Br_3 mols. is rejected (cf. A., 1935, 48), and a chain mechanism involving Br atoms and C_2H_2Br radicals is proposed. H. J. E.

Mercury-photosensitised hydrogenation of ethylene, tetradeuteroethylene, and partially-deuterated ethylenes. J. C. JUNGERS and H. S. TAYLOR (J. Chem. Physics, 1938, **6**, 325—330; cf. A., 1929, 665).—The hydrogenation of C_2H_4, 95% C_2D_4, and partly-deuterated ethylene (principally *cis*- and *trans*-CHD:CHD, with small amounts of $CH_2{:}CD_2$, C_2H_3D, and C_2HD_3) photosensitised by excited Hg (λ 2537 A.) has been studied. Under similar conditions C_2D_4 is hydrogenated more rapidly than C_2H_4, and for both the rate of hydrogenation is independent of the C_2H_4 or C_2D_4 pressure, provided excess of H_2 is present. Both give predominantly C_4H_{10} with traces of C_2H_6 (more abundant for C_2D_4 than for C_2H_4) and negligible amounts of CH_4. Possible mechanisms are discussed and that involving the reactions (1) $H + C_2H_4 = C_2H_5$, (2) $C_2H_5 + C_2H_5 = C_4H_{10}$, and, to a smaller extent, (3) $C_2H_5 + C_2H_5 = C_2H_6 + C_2H_4$ is favoured. When $[H_2]$ is low or when H_2 is absent, photosensitised polymerisation occurs. This is slower for C_2D_4 than for C_2H_4, presumably on account of differences in the zero-point energies causing differences in the rates of reaction between these mols. and the free radicals formed. W. R. A.

Photochemical formation of carbonyl chloride. X. Chlorine-sensitised formation of carbon dioxide at pressures of 100 to 10 mm. of Hg. XI. Calculation of constants of the component reactions from a consideration of the thermal formation and decomposition of carbonyl chloride. M. BODENSTEIN, W. BRENSCHEDE, and H. J. SCHUMACHER (Z. physikal. Chem., 1938, **B**, **40**, 115—120, 121—134; cf. A., 1937, I, 318).—X. At total pressures of 100 to 10 mm. Hg, as at 0·5—1 atm., the rate of formation of CO_2 at 32° $\propto [CO]^{\frac{1}{2}}$. At 26·1 mm. total pressure the quantum yield for the formation of CO_2 is 180 mols. per *hν*. The val. at 0·5 atm. is 1000 mols. per *hν*.

XI. Equations are given for the temp.-dependence of the equilibrium $CO + Cl + M \rightleftharpoons COCl + M$, and of the reactions $COCl + Cl_2 = COCl_2 + Cl$, $COCl_2 + Cl = COCl + Cl_2$, and $COCl + Cl = CO + Cl_2$. H. J. E.

Chemical activity of gas ions. Decomposition of azomethane under the influence of *X*-rays. P. GÜNTHER and H. THEOBALD (Z. physikal. Chem., 1938, **B**, **40**, 1—35).—Me_2N_2 mixed with Xe is decomposed by *X*-rays filtered through 5 mm. of Al. No decomp. occurs in absence of Xe. Over a wide range of pressure and mixture composition four mols. of Me_2N_2 are decomposed per ion pair. The ion yield falls if the ratio of Xe to Me_2N_2 exceeds 2·5 : 1. The reaction was studied with Xe and Me_2N_2 pressures of 100—500 mm. and 10—240 mm., respectively, the amount of decomp. being deduced from the N_2 formed. The results cannot be satisfactorily explained on the cluster theory. From the vals. of the dielectric consts. of the two gases, clusters are shown to consist almost entirely of Me_2N_2 mols., even at the $[Me_2N_2]$ at which the yield per ion pair falls. H. J. E.

Determination of the nature of accessory products present in small quantities in the products of a reaction by kinetic measurements. S. C. J. OLIVIER (Rec. trav. chim., 1938, **57**, 741—746).—The nature of the different accessory products formed during the chlorination of PhMe at the b.p. under different sources of illumination has been determined by kinetic measurements. W. R. A.

Photochemical interaction between ketones and secondary alcohols. C. WEIZMANN, Y. HIRSHBERG, and E. BERGMANN (Nature, 1938, **141**, 1012—1013).—The primary photochemical process is probably the activation of the CO compound which reacts with the alcohol, splitting the C·H linking, and giving two free radicals which can dimerise symmetrically or asymmetrically, or be stabilised by a second oxidation–reduction process. L. S. T.

Photochemical polymerisation of chloroprene and some related molecules. J. L. BOLLAND and H. W. MELVILLE (Rubber Tech. Conf., 1938, Preprint 90, 10 pp.).—On irradiating chloroprene (I) vapour with light of λ 2537 A. a long induction period is followed by a photo-polymerisation accompanied by visible deposition of polymeride; after prolonged illumination, a "dark" polymerisation sets in. The photo-polymerisation (which is a true polymerisation, the quantum yield being 7) occurs in the condensed stage, the (I) therefore diffusing through the polymeride before it reaches the reaction zone. The "dark" polymerisation also takes place in the condensed phase. Co-polymerisation may involve polymerides which will "grow" in the dark after illumination or those which live only for a short period. (I) will "grow" by polymerisation on a layer of polymerised $CH_2{:}CMe{\cdot}CO_2Me$ without illumination, but butadiene (II) will not. (II) shows no great tendency to photo-polymerisation and reacts with the acrylate polymeride without co-polymerisation. D. F. T.

Decomposition and synthesis of hydrogen iodide by α-particles. K. G. BRATTAIN (J. Physical Chem., 1938, **42**, 617—628).—Vals. obtained for the no. of mols. decomposed per ion pair when HI at 212—806 mm. and 25—200° was irradiated with α-particles are slightly < those recorded by Vandamme (A., 1933, 238), but both series can be explained by supposing that ⩽6 mols. of HI are decomposed per HI ion pair. A mechanism of the reaction is suggested. The combination of H_2 and I_2 can be explained by supposing that ⩽6 mols. of HI are formed per H_2 ion pair, and 1 mol. of HI per seven I_2 ion pairs, whilst 4 mols. of HI are decomposed per HI ion pair. Experiments at low $[I_2]$ indicate that either appreciable back reaction occurs, or not all H_2 ion pairs are used in synthesis.

J. W. S.

Molecular rearrangement induced by ultrasonic waves. C. W. PORTER and L. YOUNG (J. Amer. Chem. Soc., 1938, **60**, 1497—1500).—The rates of decomp. of BzN_3 in C_6H_6 and in NH_2Ph at 25° have been determined with and without the application of ultrasonic waves. The rate is accelerated greatly by ultrasonic waves. E. S. H.

Constitution of heavy water. I. R. RAO and P. KOTESWARAM (Indian J. Physics, 1938, **12**, 63—74).—Work previously recorded (A., 1938, I, 228) is described in greater detail. T. H. G.

Production of large single crystals of potassium bromide suitable for optical use. D. C. STOCKBARGER (J. Opt. Soc. Amer., 1937, **27**, 416—419).—Crushed KBr is placed in a Pt crucible supported in alundum cement which is lowered through a high temp. gradient at the rate of 1 mm. per hr. At the termination of crystallisation the crucible is inverted and the temp. raised so that the crystal commences to melt; the crucible is removed and the crystal cooled to room temp. Crystals 5 cm. in diameter and 7 cm. long were produced.

F. J. L.

Determination of the excess oxygen content of the cuprous oxide phase. C. WAGNER and H. HAMMEN (Z. physikal. Chem., 1938, **B**, **40**, 197—206).—Specimens of Cu_2O were heated at 900° and 1000° in O_2 at 0·73—33 mm. pressure, quenched in H_2O at 0°, dissolved in HCl, and the Cu^{II} determined electrometrically by titration with aq. $CrSO_4$. The Cu^{II} varied from $1·14 \times 10^{-3}$ g.-atom per g.-atom of $Cu^{I} + Cu^{II}$ at 1000° and 33 mm. O_2 pressure to $0·30 \times 10^{-3}$ (900°/0·73 mm.). The O excess increases with increasing O_2 pressure more rapidly than does the conductivity of the Cu_2O. The absorption of O_2 is discussed in terms of lattice defects and of association in the solid phase. H. J. E.

Amorphous and crystallised oxide hydrates and oxides. XLII. Catalase and peroxidase properties of cupric hydroxide and cupric oxide. A. KRAUSE [with F. KOPCZYŃSKI and J. RAJEWSKI] (Ber., 1938, **71**, [*B*], 1229—1234).—$Cu(OH)_2$ is obtained by the action of a slight excess of NaOH on $CuSO_4$ followed by desiccation in air or in a vac. over NaOH at room temp.; it contains about 25% H_2O. Cu^{II} oxide (I) obtained by gradual addition of $CuSO_4$ to boiling NaOH contains, when air-dried, about 4·3% H_2O. Further CuO with 0·9% H_2O and anhyd. ignited CuO (II) are used. $Cu(OH)_2$ causes a much more rapid decomp. of H_2O_2 than does (I), whereas (II) is almost without action. $Cu^{\cdot\cdot}$ is nearly ineffective; hence this is a case of pronounced heterogeneous catalysis caused by the OH groups (or their H atoms) present in the solid catalyst. OH ions accelerate and H ions retard the decomp. Evidence in favour of the intermediate production of Cu peroxide is adduced. Oxidation of HCO_2H by H_2O_2 proceeds more rapidly in the presence of (I) than in that of $Cu(OH)_2$ but the best results are obtained with a defined H_2O content. H_3PO_3 and As_2O_3 have pronounced restrictive action but the catalyst appears to recover in course of time.

H. W.

Amorphous and crystallised oxide hydrates and oxides. XLIII. Magnesium hydroxide as strengthening agent for the peroxidising properties of amorphous ferric hydroxide catalysts. Rate of oxidation of formic acid by hydrogen peroxide at 20°. A. KRAUSE and A. SOBOTA (Ber., 1938, **71**, [*B*], 1296—1302).—Although a mechanical mixture of $Mg(OH)_2$ and orthoferric hydroxide (I) has no greater peroxidising action than (I) alone, the product of their co-pptn. is remarkably active, 2·1% of MgO having a marked action. The products are amorphous. Since Mg ions have no influence the catalysis is heterogeneous. The strengthening is proper to the solid state and is lost when $Mg(OH)_2$ is dissolved from the solid phase. The highly active condition is attributed to the penetration of the $Mg(OH)_2$ mols. into the closely packed mol. of (I) whereby the inner surface of solid (I) is appreciably enlarged. Active spots are thus disclosed and, in addition, the already active H atoms acquire increased activation owing to the proximity of the $Mg(OH)_2$ mols. H. W.

Basic calcium salts. II. F. W. KLINGSTEDT (Acta Acad. Aboensis math. phys., 1936, **9**, pp. 26; Chem. Zentr., 1936, ii, 1873).—The following basic salts have been obtained by heating solutions of the neutral salts with CaO: $3Ca(OH)_2,CaCl_2,12H_2O$; $3Ca(OH)_2,CaBr_2,12H_2O$; $3Ca(OH)_2,CaI_2,12H_2O$; $3Ca(OH)_2,Ca(CNS)_2,9·5H_2O$; $3Ca(OH)_2,Ca(ClO_4)_2,12H_2O$; and $3Ca(OH)_2,Ca(MnO_4)_2,12H_2O$. $Ca(OH)_2,Ca(ClO_4)_2,2—4H_2O$; $Ca(OH)_2,Ca(NO_3)_2,2H_2O$, and $Ca(OH)_2,Ca(NO_2)_2,2H_2O$ have also been prepared.

L. S. T.

Influence of preparation of zinc oxide on its reduction by hydrogen. F. SCHACHERL (Publ. Fac. Sci. Univ. Masaryk, 1938, No. 255, 3—13).—The equilibrium const. of the reduction is high for ZnO prepared in an electric arc, lower for ZnO prepared by igniting $ZnCO_3$ at 350°, and still lower for that prepared by ignition at >1000°. Samples prepared at low temp. are stated to have a higher energy content owing to irregularities of crystal structure, whilst those prepared in an electric arc have a large surface energy. E. S. H.

Active oxides and reactions of solid substances. CX. Systems zinc oxide–ferric oxide and beryll-

ium oxide–ferric oxide. G. F. HÜTTIG [with R. GEISLER, J. HAMPEL, O. HNEVKOVSKY, F. JEITNER, H. KITTEL, O. KOSTELITZ, F. OWESNY, H. SCHMEISER, O. SCHNEIDER, and W. SEDLATSCHEK, (Z. anorg. Chem., 1938, **237**, 209—325).—The changes occurring when ZnO and Fe_2O_3 are heated together in varying proportions and at different temp. have been studied by means of *X*-rays, measurements of χ, and studies of the sorption of MeOH vapour and of dissolved dyes, and of the catalytic activity for certain gas reactions. Parallel measurements were carried out with the single components and with BeO–Fe_2O_3 mixtures, and the results are correlated with the scheme of intermediate stages put forward by Hüttig *et al.* (A., 1936, 1216). F. J. G.

***X*-Ray studies on the hydrous oxides. IX. Scandium oxide monohydrate.** W. B. WEISER and W. O. MILLIGAN (J. Physical Chem., 1938, **42**, 669—672; cf. A., 1937, I, 575).—Addition of alkalis to solutions of Sc salts at 25° or 100° yields a white ppt. of Sc_2O_3,H_2O, with crystal structure similar to that of γ-Al_2O_3,H_2O and distinct from that of Sc_2O_3. Dehydration isobars for this compound have been obtained. No evidence could be obtained for the existence of any second form of anhyd. Sc_2O_3 at 450—900°. The alleged $2Sc(OH)_3,H_2O$ (A., 1935, 714) is probably hydrous Sc_2O_3,H_2O. J. W. S.

Hydrous oxides of some rarer elements. H. B. WEISER and W. O. MILLIGAN (J. Physical Chem., 1938, **42**, 673—678; cf. A., 1937, I, 575).—The dehydration isobars and *X*-ray diffraction patterns of the oxides pptd. under various conditions have been investigated. Those of In, Nd, and Pr comprise hydrous trihydrates or hydroxides, and those of Ga (formed slowly or aged) and Sc are hydrous monohydrates, whilst those of Tl, Ga (formed rapidly or unaged), Y, and Sm are hydrous oxides. J. W. S.

Preparation of pure terbium oxide. W. PRANDT (Z. anorg. Chem., 1938, **238**, 65—68).—The separation of Tb from Dy and Gd by fractional crystallisation of the NH_4 double oxalates is described. The brown oxide (composition not stated), obtained by ignition, is only slowly attacked by HNO_3, with evolution of O_3, or by HCl, with evolution of O_3 and Cl_2. E. S. H.

Reactions of solid carbon with gases and liquids. O. RUFF (Z. Elektrochem., 1938, **44**, 333—341).—A lecture. Modern concepts of the structure of C and its reactions at various temp. with O_2, CO_2, F_2, and metals are discussed. C. R. H.

Pentacarbon dioxide. O. DIELS (Ber., 1938, **71**, [*B*], 1197—1200).—The possibility of the existence of C_5O_2 is not denied but the properties of the compound described by Klemenc *et al.* (A., 1937, I, 575) are not those to be expected for such a substance. H. W.

Graphite salts. W. RÜDORFF and U. HOFMANN (Z. anorg. Chem., 1938, **238**, 1—50).—Salts of graphite can be prepared by oxidation of graphite in conc. H_2SO_4, HNO_3, $HClO_4$, H_2SeO_4, H_3PO_4, $H_2P_4O_7$, or molten $As_2O_5 + CrO_3$. The salts are stable only in the conc. acids; they are decomposed by H_2O or org. liquids. With each salt, several steps of oxidation have been recognised, the highest degree of oxidation with H_2SO_4, HNO_3, and $HClO_4$ giving blue compounds. *X*-Ray investigation shows that the hexagonal planes of graphite are retained; the distance is increased from 3·34 A. to 7·98 A. for the H_2SO_4 compound, 7·94 A. for the $HClO_4$ compound, 7·84 A. for the HNO_3 compound, and 8·25 A. for the H_2SeO_4 compound. The formula determined for the blue compound with H_2SO_4 is $C_{24}^+,HSO_4',2H_2SO_4$; its structure is discussed. The acid mols. and radical can be exchanged reversibly with $HClO_4$, HNO_3, or H_2SeO_4 by treatment with the requisite acid. E. S. H.

New types of silicon compounds. R. SCHWARZ (Angew. Chem., 1938, **51**, 328—331).—An account of previously published work (A., 1937, I, 372; 1938, I, 208) is given. By heating $Si_{10}Cl_{20}H_2$ in a stream of CO_2 at 260—300° a yellow amorphous *compound* $(SiCl)_x$ is obtained. It is insol. in org. solvents, decomposed by H_2O, and by heating above 400°. It ignites in O_2 at 98° and gives an explosive product with HNO_3. The pyrolysis of $Si_{10}Cl_{20}H_2$ is complex and yields, in addition to the $(SiCl)_x$, HCl and a mixture of volatile compounds. F. L. U.

Affinity. LXXXI. Thorium phosphide. E. F. STROTZER and W. BILTZ [with K. MEISEL] (Z. anorg. Chem., 1938, **238**, 69—80).—The prep. of Th_3P_4, by the action of P vapour on Th at 650—700° in a sealed tube, is described. Th_3P_4 has d_4^{25} 8·44; it is unchanged by cold H_2O, but attacked by dil. acids with evolution of PH_3; it is stable to heating at 1100°. *X*-Ray examination shows evidence of the existence of a subphosphide. E. S. H.

Autoxidation of metallic antimony. P. WULFF, L. ZELLER, and E. BUHE (Z. Elektrochem., 1938, **44**, 360—366).—The autoxidation of Sb in solutions of widely differing p_H vals., and at various temp. and partial pressures of O_2, is rapid at first but the oxidation product forms a protective layer which influences further oxidation and the stabilising of p.d. vals. In the presence of alkali or of substances which react with Sb, the oxidation of Sb continues after the initial rapid autoxidation but at a much reduced rate. The formation of the protective layer which is insol. in the solutions, and the subsequent oxidation, presumably to Sb_2O_5, which may react with the solution and dissolve, are regarded as distinct stages. C. R. H.

Affinity. LXXIX. System niobium–sulphur. W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1938, **237**, 369—380).—The system Nb–S has been investigated by means of *X*-rays and tensimeter curves. There are a *sesquisulphide*, Nb_2S_3, which forms solid solutions with S up to approx. NbS_4, and a *monosulphide*, NbS, which forms solid solutions with Nb up to approx. Nb_2S. The increment of mol. vol. for S in the lower sulphides is 11, corresponding with semimetallic binding; in the higher sulphides it is 15, corresponding with free S. F. J. G.

Affinity. LXXXII. System tantalum–sulphur. W. BILTZ and A. KÖCHER (Z. anorg. Chem., 1938, **238**, 81—93).—Tensimetric analysis and *X*-ray examination show the existence of TaS_3, TaS_2, and a subsulphide ($TaS_{1\cdot1}$). TaS_3 has d_4^{25} 5·72 and sublimes

readily; TaS_2 has d_4^{25} 6·86 and does not sublime at 1000°. The sulphides are stable in air and changed little by dil. HCl. Resistance to conc. HCl, conc. H_2SO_4, aq. Br, or H_2O_2 is in the order $TaS_3 > TaS_2 > TaS_{1\cdot1}$; resistance to warm aq. NaOH is in the reverse order. E. S. H.

Genesis and properties of oxides. N. PARRAVANO (Chim. e l'Ind., 1938, **20**, 1—7).—A lecture. O. J. W.

Analysis of chromium nitride. H. TER MEULEN (Rec. trav. chim., 1938, **57**, 591—593).—Cr_3N is a dark green amorphous powder extremely resistant to acids. Fusion with Na_2CO_3 and KNO_3 converts the Cr into CrO_4''; this is then reduced by SO_2, pptd. by aq. NH_3, and weighed as Cr_2O_3. To determine N, about 0·1 g. of Cr_3N and about 1·0 g. of Na_2O_2 were placed in a Pt boat in a quartz tube through which O_2 was passed. On heating, N_2 was liberated. The gases issuing from the quartz tube were collected and analysed. The analyses correspond closely with the formula Cr_3N. W. R. A.

Thermal decomposition of ammonium dichromate. E. H. HARBARD and A. KING (J.C.S., 1938, 955—957).—The black product obtained by heating $(NH_4)_2Cr_2O_7$ at a temp. below its normal decomp. temp. is probably a solid solution of two or more compounds. On further heating, an olive-green oxide is formed which contains rather more O than is required by Cr_2O_3. Since this excess is not easily reduced, the compound is regarded as a non-stoicheiometric oxide. C. R. H.

Peroxy-compounds. III. State of solution of peroxytungstates (measurement of $[H^+]$ of solutions of sodium tungstate containing hydrogen peroxide). K. F. JAHR and E. LOTHER (Ber., 1938, **71**, [*B*], 1127—1142).—Mono- and hexa-tungstate solutions differ in their behaviour towards addition of H_2O_2, the former becoming more alkaline, the latter more acidic. Solutions containing 2 mols. of H_2O_2 and 1 mol. of Na_2WO_4 are colourless and have a max. p_H immediately after their prep. With increasing H_2O_2 content the solutions become increasingly yellow and less alkaline. The p_H of solutions of hexatungstate diminishes very rapidly on addition of small amounts of H_2O_2. With >12 mols. of H_2O_2 per mol. of $Na_5(HW_6O_{21})$, p_H diminishes only slowly; the solutions are colourless. In Na_2WO_4 solutions poor in H_2O_2 the reaction is mainly $[WO_4]'' + 2H_2O_2 \rightleftharpoons [HWO_6]' + OH' + H_2O$. With a larger excess of H_2O_2 the yellow ions of tetraperoxymonotungstic acid are preferably formed whereby a marked change of $[H^+]$ is not occasioned: $[WO_4]'' + 4H_2O_2 \rightleftharpoons [WO_8]'' + 4H_2O$. In hexatungstate solutions the main change is the formation of the colourless hydrogendiperoxymonotungstic acid (I); the hexatungstate ions are decomposed with liberation of H ions: $[HW_6O_{21}]^{5-} + 12H_2O_2 \rightleftharpoons 6[HWO_6]' + 9H_2O + H^+$. Addition of acid quantitatively converts monotungstate ions in presence of excess of H_2O_2 into the ions of (I), as shown by the sudden diminution of p_H after addition of 1 equiv. of $HClO_4$ to 1 mol. of Na_2WO_4. The position of this break does not alter with the concn. of the H_2O_2 if this exceeds 2 mols. per mol. of Na_2WO_4. If this mol. relationship is not attained $HClO_4$ equiv. to half the amount of H_2O_2 must be added before the break occurs. In tungstate solutions poor in H_2O_2 increased addition of acid yields successively different yellow peroxytungstic acids which have not been fully characterised. These are formed also in the course of the natural "ageing" of peroxytungstate solutions which occurs with loss of active O and is caused by the catalytic decomp. of H_2O_2 accelerated by tungstic acid. The peroxytungstic acids and the different peroxypolytungstic acids (which exist in the increasingly acidic, decreasingly peroxidic, tungstate solutions) behave as intermediates in the course of this catalytic decomp. These peroxypolytungstic acids differ from one another very appreciably in their rates of decomp. H. W.

Theory of mineral tannage. IX. Behaviour of polytungstate solutions on ageing. A. KÜNTZEL, C. RIESS, and H. ERDMANN (Collegium, 1938, 257—272; cf. B., 1937, 68).—Acidified tungstate solutions polymerise to form negatively charged aggregates having tanning properties, and resembling basic Cr solutions in some properties. A titration curve of 0·1N-Na tungstate with HCl, and back-titration curves with NaOH, both immediately and after 24 hr., have been obtained. The back-titration curves are less acid than the original. HCl has been added to 0·1N- and N-Na tungstate, respectively, in varying proportions up to 2 mols. of HCl per mol. of Na tungstate, and the p_H of each solution determined immediately, after various time intervals up to 8 days, and after subsequently boiling. With increasing proportion of acid up to 1·4 mols. of HCl per mol. of Na tungstate the aged boiled solution is increasingly less acid than the freshly prepared HCl–tungstate solution. At acid : tungstate mol. ratios 1·5—1·6 the p_H–time curve follows an irregular course. H_2O is eliminated in the polymerisation of tungstate solutions in a manner similar to that involved in the olation of basic Cr solutions. The ageing of tungstate solutions differs from that of basic Cr solutions in that hydrolysis of tungstate solutions is small, the p_H of boiled HCl–tungstate solution does not alter further on ageing cold, and the tungstate polymerises to form different compounds, the mol. wts. of which are in some simple stoicheiometrical relation to one another, whereas basic Cr salts polymerise to form compounds of the same structure but varying mol. wt. D. P.

Manganese perchlorate and per-rhenate. J. G. F. DRUCE (J.C.S., 1938, 966).—$Mn(ClO_4)_2,6H_2O$ can be obtained by dissolving $MnCO_3$ in $HClO_4$ and concentrating the clear filtrate over anhyd. $Mg(ClO_4)_2$. The anhyd. salt cannot be prepared pure. $Mn(ReO_4)_2,3H_2O$ and the anhyd. salt can be similarly prepared from $HReO_4$. $Mn(ReO_4)_2$ does not melt below 300° but at higher temp. Re_2O_7 and Mn_3O_4 are formed. C. R. H.

Preparation of iron by reduction with hydrogen. P. M. ZAVELEVITSCH (Sborn. Rabot Lab. Inst., 1937, **15**, 51—57).—The prep. of finely divided Fe, suitable for pharmaceutical and analytical work, by reducing Fe_2O_3 is described. The latter is best prepared from $Fe(OH)_3$ which is obtained by pptn. of $Fe(NO_3)_3$ with aq. NH_3. The optimum reduction temp. is 700°; the time required to reduce 20 g. of

oxide, including the heating-up period from 400° to 700°, is 1 hr.; the quantity of H_2 required is 4·5 times the theoretical. After reduction the product should be cooled in a current of H_2 to 400° and not to 60—80°, which is usually recommended. D. G.

Behaviour of ferric and thorium hydroxides, as a function of the pretreatment and preparation, studied by the Otto Hahn emanation method. H. GÖTTE (Z. physikal. Chem., 1938, **B**, **40**, 207—230).—Rapidly pptd. $Fe(OH)_3$ shows a rapid increase in emanation loss at 850°, followed by a min. at 1000°. Slowly pptd. material does not show this effect, but it can be induced by ageing in H_2O at 100° for 12 hr. or by heating at 600° in a moist atm. For $Th(OH)_4$ there was little difference between emanation loss–temp. curves for material pptd. slowly or rapidly. $Th(OH)_4$ aged in hot H_2O showed a much greater loss at 100—1000° than unaged material. When heated in a moist gas stream it gave a max. at 850°. Ageing under H_2O causes crystallites to form in $Th(OH)_4$. These form larger crystals at >700°. This behaviour was confirmed by *X*-ray observations. The emanation loss from active $Zn(OH)_2$ is increased by dilution with an amorphous material, *e.g.*, $Fe(OH)_3$. In general the presence of cryst. material diminishes the emanation loss. H. J. E.

Reversible reaction between a complex metal-ammine ion and hydrogen ions. G. A. BARBIERI and C. FERRARI (Ric. sci. Progr. tech., 1936, [ii], **7**, 390—391; Chem. Zentr., 1936, ii, 1834).—Contrary to the general case, the cation of the Fe dipyridyl compounds can react according to $[Fe(dipy)_3]^{\cdot\cdot} + 6H^{\cdot} \rightleftharpoons Fe^{\cdot\cdot} + 3[dipyH_2]$. The same equilibrium is reached with H_2SO_4 solutions of $FeSO_4$ as with acids. At 90° equilibrium is quickly reached and is thrown to the right, but on cooling the normal equilibrium colour returns. L. S. T.

Dehydration of cobalt sulphate heptahydrate. R. ROHMER (Compt. rend., 1938, **206**, 1573—1575).—In contact with aq. H_2SO_4 of suitable concn., $CoSO_4,7H_2O$ is progressively dehydrated to hydrates containing 6, 4, 2, and $1H_2O$ (cf. A., 1934, 1187) and to the anhyd. salt. The rate of dehydration increases with temp. and $[H_2SO_4]$. A. J. E. W.

Stereoisomerism of cobaltitrinitrotriammines. (MME.) R. DUVAL (Compt. rend., 1938, **206**, 1652—1654).—Two distinct *X*-ray powder diagrams have been obtained with specimens of $[Co(NO_2)_3(NH_3)_3]$ prepared by different methods, indicating the existence of stereoisomerides in the solid state. Vals. of *n* and A for the aq. solutions, and their absorption spectra, are identical. A. J. E. W.

α-Form of the hydroxides of bivalent metals. W. FEITKNECHT (Helv. Chim. Acta, 1938, **21**, 766—784).—$Co(OH)_2$, $Zn(OH)_2$, and $Cd(OH)_2$, freshly pptd. by NaOH (α-forms), yield closely similar *X*-ray diagrams, with only *hk*0- and weak broad 001-patterns. From these measurements and from the chemical behaviour it is inferred that the forms comprise ordered layers of structure similar to those of the *C*6-forms, separated by intermediate layers of disordered hydroxide mols. There are 4 mols. in the ordered state to one in the disordered state, the metal atom of the latter being probably bound by homopolar linkages, thus accounting for the blue colour of α-$Co(OH)_2$ as compared with the rose colour of the *C*6-form. Half of the OH′ in the disordered layer can be replaced by Cl′. α-$Co(OH)_2$ can be stabilised by polyhydric alcohols or sugar, probably owing to their being strongly adsorbed. α-$Zn(OH)_2$ is capable of existence only when part of the OH′ is replaced by anions. When the latter are eliminated the ordered layers also lose their arrangement, yielding amorphous $Zn(OH)_2$. The α-form has not yet been obtained with $Ni(OH)_2$. Mixed hydroxides of Zn with Ni and Co have similar structure to the α-forms of the pure hydroxides. The intermediate layer in the former comprises $Zn(OH)_2$, whilst that of the latter is initially $Co(OH)_2$, but on ageing this is replaced by $Zn(OH)_2$, a colour change occurring from blue to rose. J. W. S.

Dehydration of nickel and potassium nickel sulphates. (MME.) N. DEMASSIEUX and B. FEDEROFF (Compt. rend., 1938, **206**, 1649—1651).—The dehydration by heating of $NiSO_4,7H_2O$ (I) and $K_2SO_4,NiSO_4,6H_2O$ (II) has been studied; *X*-ray diagrams illustrating the process are given. (I) begins to lose H_2O at room temp., giving successively $NiSO_4,6H_2O$ (stable up to 85°), $NiSO_4,H_2O$ (stable at >250°), and $NiSO_4$ above 350°. $NiSO_4$ gives $NiSO_4,6H_2O$ on exposure to the atm. (II) loses H_2O at >105°, and dehydration is complete at 250°; (II) is re-formed on exposure. During dehydration a salt may exist in a state giving no *X*-ray diagram (cf. A., 1937, I, 119). A. J. E. W.

Ruthenium ammines. VIII. Praseo-salts. Dibromo-series. IX. Violeo-salts. Dichloro-series. X. Violeo-salts. Dibromo-series. K. GLEU and W. BREUEL (Z. anorg. Chem., 1938, **237**, 326—334, 335—349, 350—358).—VIII. When $[Ru^{II}(NH_3)_4(SO_2)Br]Br$ is oxidised with Br, *trans-dibromotetramminoruthenium*^{III} *perbromide*, $[Ru^{III}(NH_3)_4Br_2]Br,Br_2$ is pptd., and from it by double decomp. other *bromo-praseo-salts* may be obtained, viz.: $[Ru(NH_3)_4Br_2]Br,H_2O$, (I) also *anhyd.*; $[Ru(NH_3)_4Br_2]Cl,H_2O$; $[Ru(NH_3)_4Br_2]NO_3$; $[Ru(NH_3)_4Br_2]SO_4H$; $[Ru(NH_3)_4Br_2]SO_4Ag$; $[Ru(NH_3)_4Br_2]_2SO_4$; $[Ru(NH_3)_4Br_2]_2S_2O_6$. They are deep red or brown and very stable to acids. The Br is more firmly bound than in the corresponding Co salts. The *trans*-configuration follows from the method of prep. (I) is paramagnetic, χ 4·039 × 10^{-6} at 21°, corresponding with a mol. moment of approx. 2 Bohr magnetons.

IX. When $[Ru(NH_3)_5(OH)]S_2O_6$ is warmed with aq. $H_2C_2O_4$, *oxalatotetramminoruthenium*^{III} *dithionate*, $[Ru(NH_3)_4C_2O_4]_2S_2O_6$ (II), is pptd. It is almost insol., yellow, and paramagnetic, χ 4·680 × 10^{-6} at 20°. When boiled with conc. HCl, (II) affords *cis-dichlorotetramminoruthenium*^{III} *chloride*, $[Ru(NH_3)_4Cl_2]Cl,0{\cdot}75H_2O$, χ 5·678 × 10^{-6} at 20°. From it other *chloro-violeo-salts* may be obtained by double decomp., viz., $[Ru(NH_3)_4Cl_2]NO_3$; $[Ru(NH_3)_4Cl_2]_2SO_4,H_2O$, also with $1{\cdot}5H_2O$; $[Ru(NH_3)_4Cl_2]_2S_2O_6$. They are yellow, and the χ-vals. correspond with a mol. moment of approx.

2 Bohr magnetons. The *cis*-configuration follows from the method of prep. The Cl is more firmly bound than in the corresponding Co salts, but less so than in the *praseo*-Ru salts. A comparison with the dichlorotetrammino-Ir^{III} salts indicates that these also have the *cis*-configuration. On prolonged heating with HCl the *violeo*-Ru salts afford *trichlorotriamminoruthenium*, $[Ru(NH_3)_3Cl_3]$, as a sparingly sol. red ppt.

X. By a method similar to that employed for the *cis*-dichloro-salts (cf. preceding abstract) the following cis-*dibromotetramminoruthenium*^{III} *salts* have been obtained: $[Ru(NH_3)_4Br_2]Br,0{\cdot}5H_2O$ (III); $[Ru(NH_3)_4Br_2]NO_3$; $[Ru(NH_3)_4Br_2]_2SO_4,H_2O$; $[Ru(NH_3)_4Br_2]_2S_2O_6$. They are brown or red and paramagnetic; (III) has χ $3{\cdot}761 \times 10^{-6}$ at 20°, corresponding with a mol. moment of approx. 2 Bohr magnetons. The dihalogenotetrammino-Ru^{III} salts prepared by the authors (cf. A., 1938, I, 321, and above) are different from the derivatives of Ru-red described by Morgan and Burstall (A., 1936, 302), and the formulation of the latter compounds as dihalogenotetrammino-salts, and the corresponding formula for Ru-red, are rejected. F. J. G.

Dithiocarbamates of ruthenium, rhodium, and palladium. L. Malatesta (Gazzetta, 1938, **68**, 195—198; cf. A., 1937, I, 606).—The *compounds* $M[S{\cdot}CS{\cdot}NR_2]_3$ (M = Ru, Rh; R = Me, Et, Bu) and $Pd[S{\cdot}CS{\cdot}NR_2]_2$ are described. The Ru^{III} compounds are paramagnetic with a susceptibility corresponding with one electron spin; the Rh^{III} and Pd^{II} compounds are diamagnetic. O. J. W.

Compounds of platinum and carbon monoxide. A. Gelman and M. Bauman (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 645—648; cf. A., 1937, I, 630; II, 282; 1938, I, 43).—CO complexes, less stable than the C_2H_4 analogues, have been prepared. $K[CO\ PtCl_3]$, prepared in solution by the action of CO on K_2PtCl_4 at room temp., yields with aq. C_5H_5N *trans*-$[CO(C_5H_5N)PtCl_2]$ (I), m.p. 127° (decomp.). The equilibrium (I) $\underset{C_5H_5N}{\overset{HCl}{\rightleftharpoons}}$ $(C_5H_5N)H[CO\ PtCl_3]$ is established. The NH_3 analogue of (I) was not obtained. Aq. Koss' (NH_3) salt yields with CO, at 11—13° only, *cis*-$[CO\ NH_3\ PtCl_2]$ (II), decomp. at 180°. Properties of (I) and (II) are contrasted. Comparison of CO, C_2H_4, NO_2, and NO complexes with those of NH_3, NO_3', and halogens emphasises unsaturation (of C, N), not polarisability, as the *trans*-influence. I. McA.

Anodic dissolution as a method of microchemical analysis. A. Glazunov (Österr. Chem.-Ztg., 1938, **41**, 217—223; cf. B., 1932, 1121; 1937, 578).—A piece of filter-paper soaked in a suitable reagent is placed between the surface of the specimen to be examined and a metal (Al) cathode. On connecting the specimen to the anode a small amount of the metal passes into solution in the reagent and is identified by the characteristic colour produced. The method has been applied to the study of the macro-structure of alloys, the examination of protective metal coatings, the analysis of minerals, etc. Its further development is dependent on the possibility of discovering sp. org. reagents suitable for the purpose. A. B. M.

Calculation of corrections for volume of precipitate in titrating with an aliquot part of filtrate. P. I. Alexeev (Sborn. Rabot Lab. Inst., 1937, **15**, 79—90).—Formulæ for calculating results of analyses, including corrections for the vol. of ppt., in titrating an aliquot part of a filtrate are given. Examples illustrate the magnitude of the errors due to the vol. of ppt. D. G.

Quantitative analysis of mixtures of strong and weak acids, buffer and neutral salts, with special reference to leather and tanning extracts.—See B., 1938, 820, 821.

p_H of sea-water as measured with the glass electrode. E. G. Ball and C. C. Stock (Biol. Bull. Wood's Hole, 1937, **73**, 221—226).—Since the H_2 electrode is unreliable for determining the p_H of sea-H_2O it was compared with the glass electrode using buffer solutions to which sea salts in concn. similar to that of sea-H_2O were added. Approx. the same p_H vals. were obtained. Hence the glass electrode is suitable for use with sea-H_2O, giving an accuracy of $\pm 0{\cdot}03$ p_H. A. D. H.

Determination of moisture in carnallites by the carbide method.—See B., 1938, 777.

Detection and determination of alkali and alkaline-earth chlorides and bromides in presence of the cyanides and thiocyanates. E. Schulek (Z. anal. Chem., 1938, **112**, 415—417).—The solution containing approx. 0·5 g. of alkali cyanide, 5—160 mg. of bromide or 3—70 mg. of chloride, excess of NaOH and 30% H_2O_2 is boiled for 10 min. to convert the CN' into NH_3 and CO_3''. After cooling, the solution is acidified with HNO_3 and the halogen determined volumetrically by Volhard's method. The method fails for iodide. In presence of CNS' a second treatment with H_2O_2 is necessary. The CNS' is converted into CO_3'', SO_4'', and NH_3. L. S. T.

Determination of fluorine in insecticide products.—See B., 1938, 829.

Standardisation of thiosulphate solutions by means of copper and cupric sulphate. H. W. Foote (J. Amer. Chem. Soc., 1938, **60**, 1349—1350).—The reaction $CuSO_4 + 2KI \rightarrow CuI + I + K_2SO_4$ offers advantages in the standardisation of aq. $Na_2S_2O_3$; it is quant. if NH_4CNS is added just before the end-point in order to liberate I adsorbed by CuI. The mean deviation from the I standard in 25 determinations was 1 part in 1300. E. S. H.

Determination of sulphur in steel and ferrous alloys by combustion.—See B., 1938, 794.

Determination of sulphur in metals.—See B., 1938, 797.

Determination of sulphur in petroleum and lubricating oils.—See B., 1938, 756.

Determination of hydrogen sulphide in air.—See B., 1938, 851.

Determination of sulphur dioxide, sulphite, etc. in sulphited [vegetable tanning] extracts.—See B., 1938, 820.

Determination of sulphur dioxide in presence of nitrogen oxides.—See B., 1938, 779.

Simultaneous conductometric titration of sulphuric and nitric acids. C. J. VAN NIEUWENBURG (Rec. trav. chim., 1938, **57**, 616—619).—Reduction of $[H^+]$ by the addition of excess of an exactly neutral solution of an alkali salt of a moderately strong acid makes it possible to determine conductometrically H_2SO_4 and HNO_3 in the same solution by means of a single titration. A procedure using $CH_2Cl{\cdot}CO_2Na$ is described in detail. W. R. A.

Separation of tellurium from selenium in the analysis of ores.—See B., 1938, 780.

Possibility of misinterpreting the results of nitrogen determinations by the micro-Dumas method. (MISS) H. J. RAVENSWAAY and A. SCHWEIZER (Rec. trav. chim., 1938, **57**, 688—693).—N analysis by the micro-Dumas method (I) on humine (a by-product obtained in preparing lævulic acid by dehydrating sucrose with dil. HCl) revealed presence of up to 2·4% N; no N was found by the Ter Meulen method. Analysis of the gas suspected from (I) to be N_2 indicated that it was CH_4. High N_2 analyses by (I) are possibly due to the liberation of a gas (*e.g.*, CH_4) by the substance undergoing analysis. The importance of checking results from (I) by either the Ter Meulen or Kjeldahl methods is stressed. W. R. A.

Micro-determination of nitrogen in steels.—See B., 1938, 794.

Assay of nitrogen monoxide.—See B., 1938, 779.

[Colorimetric determination of ammonia, nitrite, lead, and cadmium in air.]—See B., 1938, 851.

Coulometric analysis as precision methods. IV—VII. L. SZEBELLÉDY and Z. SOMOGYI (Z. anal. Chem., 1938, **112**, 385—390, 391—395, 395—399, 400—404; cf. A., 1938, I, 368).—IV. Optimum conditions and details of procedure for the determination of HCNS by oxidation with Br liberated from KBr by electrolysis in 5—10% HCl solution at 0—5° are given. The Br consumed by the HCNS + the slight excess in the electrolyte solution (determined by means of KI and 0·01N-$Na_2S_2O_3$) is found from the wt. of Ag deposited in a coulometer.

V. Details are given for the determination of N_2H_4 utilising the reaction $N_2H_4 + 2Br_2 = 4HBr + N_2$ by a procedure similar to that given above. Electrolysis is carried out in 10—20% HCl solution at 60—65°. The method gives results in agreement with the bromate method of Kurtenacker *et al.* (A., 1924, ii, 778).

VI. The method described for the determination of NaOH involves the electrolysis of a solution of the NaOH containing excess of $KHSO_3$ and KBr. The solution remains alkaline until the $KHSO_4$ formed is equiv. to the NaOH present. The reactions are $KHSO_3 + O = KHSO_4$ and $KHSO_4 + NaOH = KNaSO_4 + H_2O$. Bromocresol-green is used as indicator. The amount of NaOH present is found from the wt. of Ag deposited. Stirring by means of N_2 or H_2 is essential.

VII. For the determination of NH_2OH the reaction with electrolytically-produced Br cannot be used in acid solution owing to the formation of significant amounts of nitrite, but in neutral solution a sharp end-point can be obtained. Electrolysis is best carried out at 60—65°. As in former determinations the excess of Br is found by means of 0·01N-$Na_2S_2O_3$, and the total Br produced from the KBr by means of the Ag coulometer. Details of procedure and a comparison showing agreement with vals. obtained by the bromate method of Kurtenacker *et al.* (A., 1922, ii, 312) are given. L. S. T.

Colorimetric micro-determination of phosphorus with the Pulfrich photometer. F. ROTHSCHILD (Klin. Woch., 1936, **15**, 792—793; Chem. Zentr., 1936, ii, 1983).—A method (±2%) suitable for series determinations is described. A. H. C.

Determination of phosphates in water.—See B., 1938, 852.

Determination of phosphorus in coal.—See B., 1938, 748.

Gold bromide as redox indicator and catalyst in determination of arsenites by cerium sulphate. L. SZEBELLÉDY and S. TANAY (Pharm. Zentr., 1938, **79**, 383—385).—The arsenite solution is treated with 10 c.c. of fuming HCl, 1 c.c. of 1% $AuCl_3$, 2 g. of NaBr, and sufficient H_2O to make 100 c.c. The colourless liquid is warmed to 50—60° and titrated with 0·1N-$Ce(SO_4)_2$ until one drop of the latter produces the characteristic yellow colour of the Na auribromide which is compared with a control. ICl is not necessary as a catalyst. J. N. A.

Rapid oxidimetric determination of arsenic. E. ERDHEIM and N. ZAHARIA (Österr. Chem.-Ztg., 1938, **41**, 242—244).—2—3 g. of the finely powdered material are fused with a corresponding amount of Na_2O_2, the product being extracted with H_2O and the solution diluted to 500 c.c. An aliquot portion of the filtered solution is neutralised with 20% H_2SO_4 and then rendered slightly alkaline by addition of $NaHCO_3$. 30—40 c.c. of aq. Na_2SO_3 (160 g. per l.), 40—50 c.c. of 3% NH_4 molybdate solution, and 60—70 c.c. of dil. H_2SO_4 are then added and the solution is boiled until the odour of SO_2 disappears. The solution is titrated with $KMnO_4$ (1 c.c. of 0·1N-$KMnO_4$ = 0·0037455 g. As). J. W. S.

Determination of boric acid. E. PERCS (Magyar Gyóg. Társas. Ert., 1936, **12**, 318; Chem. Zentr., 1936, ii, 1383).—The use of 3% phenolphthalein and 0·2% methylene-blue in EtOH solution is recommended as indicator in the titration of H_3BO_3 using 3 parts of glycerol. A. H. C.

Analysis of boron carbide.—See B., 1938, 798.

Determination of silicon in aluminium and its alloys.—See B., 1938, 802.

Differentiation between felspar and quartz.—See B., 1938, 777.

Potentiometric determination of silica in silicate ores.—See B., 1938, 783.

Drop reaction for the detection of phosgene. V. ANGER and S. WANG (Mikrochim. Acta, 1938, **3**,

24—26).—The reaction between $COCl_2$ and phenylhydrazine cinnamate to form diphenylcarbazide, which is then converted into its reddish-violet Cu salt, provides a drop reaction for $COCl_2$ which can be applied as a test for purity to CCl_4 and $CHCl_3$. The test is sensitive to 5 μg. of $COCl_2$ per drop and can be made on paper or in a micro-crucible. L. S. T.

Determination of carbon in aluminium.—See B., 1938, 802.

Detection of carbon monoxide in medicinal oxygen.—See B., 1938, 779.

Determination of total alkali metals present as impurities in reagents. E. S. PRSHEVALSKI and R. V. MERVEL (Sborn. Rabot Lab. Inst., 1937, **15**, 58—68).—The determination of $Na^{\cdot}$, introduced into various reagents as Na_2SO_4, by pptn. of the reagent cation and subsequent weighing of the H_2O-extracted and calcined filtrate is described. The accuracy is dependent on the anion chosen to ppt. the reagent cation since Na_2SO_4 is adsorbed by different ppts. in varying extent. Thus errors vary for the SO_4'', CO_3'', OH', and S' by 19, 11, 7, and 4%, respectively. Presence of small quantities of $CaSO_4$ as impurity invalidates the alkali metal determination owing to the solubility of this salt. D. G.

Iodometric determination of alkalis. P. I. ALEXEEV (Sborn. Rabot Lab. Inst., 1937, **15**, 74—78).—Addition of $AgNO_3$ to a solution of I in KI ppts. I' and IO_3' and liberates a quantity of $H^{\cdot}$ equiv. to that of the I originally in solution. The alkali solution to be determined is added and part of the acid liberated by the $AgNO_3$ is combined; the remainder is determined by adding KI and KIO_3, which again liberate I in quantity equiv. to the acid remaining, and by titration with As_2O_3. The alkali is determined from the difference between the amount of titrated I solution initially taken and that found at the end. D. G.

Electrometric titration of calcium in chloride solutions. A. CARIS (Z. Elektrochem., 1938, **44**, 366—367).—The solution of $CaCl_2$, adjusted to p_H 5—9, is titrated with $(NH_4)_2C_2O_4$ using a Pb-amalgam electrode. The titration is slightly affected by the presence of other ions, but the effect is negligible in the case of small amounts of $K^{\cdot}$ and $NH_4^{\cdot}$. C. R. H.

Principles and applications of absolute colorimetry. XVIII. Absolute-colorimetric determination of magnesium. A. THIEL and E. VAN HENGEL (Ber., 1938, **71**, [*B*], 1157—1162).—The method depends on the formation of a lake between $Mg^{\cdot\cdot}$ and 1 : 2 : 5 : 8-tetrahydroxyanthraquinone. The presence of a protective colloid is therefore necessary, gum arabic being suitable if freed from Mg which is usually present. The solution, which must not contain more than 0·8 mg. in the sample and must not be strongly acidic or contain much NH_4, is mixed with 10 c.c. of gum arabic solution, 10 c.c. of dye solution, and 10 c.c. of NaOH and made up to 100 c.c. The colour develops immediately and remains unchanged for ⩽30 min., after which it gradually becomes paler. The solution is observed in a 25-mm. layer using filter SF9 (600 mμ.) If <23 mm. is observed on the grey solution side the Mg content is too small for the dye used, and the process is repeated with only 4 c.c. of dye solution per 100 c.c., the layer being 50 mm. If in the first case >31·5 mm. of grey solution are required, the experimental solution is too conc. and must be diluted or used in smaller quantity. The Mg contents corresponding with thicknesses of the grey solution are tabulated. Foreign cations except the alkali metals may not be present. If much Al is present special precautions are necessary owing to the adsorptive power of $Al(OH)_3$ for $Mg(OH)_2$. A suitable treatment consists in dissolution of the $Al(OH)_3$ in NaOH. Al–Mg alloys are best directly treated with NaOH. H. W.

Adsorption of diazo-compounds on cadmium and magnesium hydroxides. V. "Cadion 2B" for micro-detection of magnesium. F. P. DWYER (J. Proc. Austral. Chem. Inst., 1938, **5**, 197—200; cf. A., 1938, I, 212).—Procedure for the detection of ⩽0·08 μg. of Mg per c.c. in a 10-c.c. sample is described. Cd and Mg may be detected in the same solution. In presence of other metals Mg is detected after the conversion of these into complex cyanides. The sensitivity of "Cadion 3B," which can also be used, is 1 μg. of Mg per c.c. F. L. U.

Volumetric determination of magnesium. G. DONATELLI (Annali Chim. Appl., 1938, **28**, 122—125).—Mg is pptd. as $MgNH_4PO_4$; the ppt. is separated, washed with 95% EtOH, dried at 45—50°, suspended in H_2O, and titrated to Me-orange with 0·1N-H_2SO_4. The method is applicable to the determination of PO_4'''. F. O. H.

Determination of magnesium oxide in limestones.—See B., 1938, 777.

Analysis of fluxes used in the production of magnesium.—See B., 1938, 801.

Determination of impurities in zinc and zinc alloys.—See B., 1938, 796.

Spectrographic determination of impurities in commercial cadmium.—See B., 1938, 797.

Analysis of refined lead.—See B., 1938, 797.

Determination of copper in cyanide electrolytes.—See B., 1938, 803.

Determination of copper by internal electrolysis.—See B., 1938, 803.

Determination of copper in rubber.—See B., 1938, 817.

Micro-determination of copper and zinc in aluminium and magnesium alloys.—See B., 1938, 802.

Determination of copper in presence of lead.—See B., 1938, 795.

Determination of copper and bismuth in lead–zinc ores by internal electrolysis.—See B., 1938, 796.

Determination of copper and iron in wines.—See B., 1938, 834.

Pharmaceutically important arsenic compounds. III. Stability of arsenites towards atmospheric oxygen and their use for the de-

termination of mercuric chloride. K. BRAND and E. ROSENKRANZ (Pharm. Zentr., 1938, **79**, 377—383; cf. A., 1937, II, 491).—The stability of arsenite solutions decreases in presence of alkali, which favours formation of arsenate. The various methods for determination of $HgCl_2$ by reduction with arsenite and back-titration with I are discussed. Low results are obtained when NaOAc is used as the alkali due to formation of some Hg_2Cl_2, but good results are secured by use of Na_2HPO_4 or $Na_2B_4O_7$. J. N. A.

Detection of the rare earths by means of the fluorescence of their bivalent ions. K. PRZIBRAM (Mikrochim. Acta, 1938, **3**, 68—72).—The characteristic fluorescence bands shown by Eu, Yb, Sm, and Tm (cf. A., 1938, I, 384) can be used for the detection of small amounts of these elements. L. S. T.

Colorimetric determination of aluminium by means of eriochrome-cyanine-*R*. I. T. MILLNER. **II.** T. MILLNER and F. KÚNOS (Z. anal. Chem., 1938, **113**, 83—102, 102—119).—I. The interaction of $Al^{...}$ and eriochrome-cyanine-*R* (I) has been investigated by extinction coeff. measurements on solutions of the dye with and without addition of $AlCl_3$. At p_H 5·4 (NaOAc–AcOH buffer solution) the lake formed has a const. composition corresponding with 3 mols. of (I) to 1 atom of Al, but the mols. of (I) are not equally bound. The increase in the extinction coeff. due to addition of $Al^{...} \propto [Al^{...}]$, and is almost independent of the amount of excess (I) present; it therefore permits determination of small amounts of Al.

II. In NaOAc–NaOAc buffer solutions of p_H 4·6—5·6 (I) gives a much deeper coloured lake that that formed in equiv. NH_4OAc–NaOAc–AcOH buffer solutions. From the effects of the method of prep. of (I), p_H, and time of keeping on the colour developed it is inferred that an equilibrium exists between two forms of (I), only one of which is capable of forming a deeply coloured lake. In the preferred method for determining $Al^{...}$, 5 c.c. of HCl solution containing >15 μg. of Al are treated with 1·5 c.c. of 1% aq. (I) and 2N-NaOH is added till a pale green ppt. is formed. After adding a few more drops of NaOH, 0·2N-AcOH is added until a pale yellow colour is obtained. 15 c.c. of buffer solution ($NaOAc,3H_2O$ 14·2 g., AcOH 1·74 g. per l.) are added and the solution is diluted to 25 c.c. A blank solution without Al is also prepared, and both are kept for 20 hr., after which the colours are compared. The $[Al^{...}]$ is deduced from measurements on standard solutions. J. W. S.

Spectrum analysis of aluminium alloys in the visible region of the spectrum.—See B., 1938, 802.

Detection of iron by catalysis. L. SZEBELLÉDY and M. AJTAI (Mikrochim. Acta, 1938, **3**, 21—23).—The catalytic acceleration of the reaction between H_2O_2 and *p*-phenetidine by the Fe^{II} dipyridyl complex forms the basis of a drop reaction for Fe. 0·1 c.c. of 0·01% *p*-$NH_2{\cdot}C_6H_4{\cdot}OEt,HCl$, one drop of 2%EtOH solution of 2 : 2′-dipyridyl, and 0·1 c.c. of 0·2% H_2O_2 are added to a drop of the neutral Fe solution. In presence of Fe the solution is coloured red either immediately or after heating on the H_2O-bath for 1—5 min., while a "blank" remains colourless or faintly pink. The limit of identification is 0·001 μg. of $Fe^{..}$ per 0·1 c.c. of tested solution. L. S. T.

Analysis of special cast irons and steels.—See B., 1938, 792.

Rapid determination of iron in slags.—See B., 1938, 791.

Colorimetric determination of small quantities of iron oxide in glasses and glass-making sands.—See B., 1938, 783.

Oxidimetric and colorimetric determination of cobalt in steel.—See B., 1938, 794.

Quantitative electrodeposition of cobalt.—See B., 1938, 804.

Volumetric determination of nickel. N. KAMINSKI and P. KAMINSKAJA (Maslob. Shir. Delo, 1938, No. 3, 17—18).—Minor modifications of Krupenio's method (A., 1937, I, 478) are described. R. T.

Determination of chromium in chromite ores.—See B., 1938, 797.

Analysis of molybdenum [ores].—See B., 1938, 797.

Spectrum analysis of minerals for tin, tungsten, and molybdenum.—See B., 1938, 797.

Gravimetric determination of germanium. G. R. DAVIES and (SIR) G. T. MORGAN (Analyst, 1938, **63**, 388—397).—Existing methods (pptn. as GeS_2 and conversion into GeO_2, pptn. as Mg_2GeO_4, and pptn. as pyridine germanomolybdate) are critically discussed and two new methods, based on pptn. with tannin and as cinchonine germanomolybdate, are described. For the former, 50—60 mg. of GeO_2 in 150—250 ml. of solution are treated with H_2SO_4 and $(NH_4)_2SO_4$ and heated almost to boiling. 10—30 ml. of 5% aq. tannin are slowly added, and the ppt. which forms is washed with a solution of HNO_3, NH_4NO_3, and tannin, collected, and ignited to GeO_2. The procedure in presence of a no. of other metals is described. In the second method, the ppt. has the formula $(C_{19}H_{22}ON_2)_4H_4[GeMo_{12}O_{40}]$, $\equiv$ 2·385% of Ge. 40 ml. of the solution containing >4 mg. of Ge are treated with NH_4NO_3, NH_4 molybdate, HNO_3, and 2·5% cinchonine in 0·25N-HNO_3. The mixture is kept for 2—4 hr., and the ppt. is collected, washed with with NH_4NO_3–HNO_3, and dried at 160°. E. C. S.

Determination of vanadium in ferrochrome. I. WADA and R. ISHII (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 434—444).—Difficulty in the determination of V in Fe–Cr alloys by the $FeSO_4$ method is overcome by first converting the Cr into a sol. Cr salt and extracting the latter with Et_2O. J. A. D.

2 : 3 : 7-Trihydroxy-9-methyl-6-fluorone, a micro-qualitative reagent for antimony. P. WENGER, R. DUCKERT, and C. P. BLANCPAIN (Mikrochim. Acta, 1938, **3**, 13—20; cf. A., 1938, I, 46).—Limits of identification are 0·2, 0·5, and 0·8 μg. on spot-plate, gelatin paper, and filter-paper, respectively. L. S. T.

Gold bromide as redox indicator in the bromometric determination of antimonite ions. L. SZEBELLÉDY and W. MADIS (Mikrochim. Acta, 1938, **3**, 1—3).—$NaAuBr_2$ and $NaAuBr_4$ act as reversible

redox indicators for the macro- or micro-determination of Sb^{***} by titration with $KBrO_3$ in presence of conc. HCl and KBr. On the macro-scale an accuracy equiv. to $\pm 0{\cdot}01$ c.c. of 0·1N-$KBrO_3$ can be attained. The results agree with potentiometric determinations. Details of procedure for micro-determinations are given. L. S. T.

Volumetric determination of bismuth as bismuth hydrogen iodide oxine. I. M. KOLTHOFF and F. S. GRIFFITH (Mikrochim. Acta, 1938, **3**, 46—51).—A crit. investigation of the determination of Bi as $C_9H_7ON{\cdot}HBiI_4$ by Berg and Wurm's method (A., 1927, 847), which is found to give low (1%) results. In the modified method recommended the excess of I′ is determined by Andrews' ICl method after pptn. and removal of the Bi compound. The final concn. of H_2SO_4 or HNO_3 after pptn. can be 1N without affecting the results, but with a chloride concn. >0·08N low results are obtained. For macro-amounts of Bi the accuracy of the method described is $\sim \pm 0{\cdot}3\%$, and for amounts of $\sim 0{\cdot}25$ mg. the indirect method given is accurate to approx. $\pm 5\%$ (cf. A., 1936, 180). L. S. T.

Gravimetric determination of bismuth with picric acid. H. ETIENNE (Bull. Soc. chim. Belg., 1938, **47**, 287—303).—Bi can be separated from Pb by rendering its solution slightly acid with HNO_3, adding excess of picric acid, and neutralising to Me-orange with $(NH_4)_2CO_3$. The Bi is pptd. as $Bi(OH)_2{\cdot}O{\cdot}C_6H_2(NO_2)_3$ (I), which is washed with dil. aq. picric acid (0·5 g. per l.). In presence of large quantities of Pb a double pptn. is necessary. If the Bi_2O_3 content is >0·01 g., (I) is converted into $Bi_2(CO_3)_3$ by boiling with excess of aq. $(NH_4)_2CO_3$. The $Bi_2(CO_3)_3$ or (I) is dissolved in HNO_3, the solution evaporated, and the residue ignited and weighed as Bi_2O_3. The separation is unaffected by the presence of Cu and Cd, but is influenced by Fe, H_3PO_4, and H_3AsO_4. In the case of a complex mixture, Bi is separated with the other metals of its group by H_2S and Na_2S, the sulphides are extracted with HCl, and then converted into nitrates before treatment with picric acid. J. W. S.

Quantitative separation of niobium and titanium. V. S. BIKOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 655—657).—Where Ta–Nb separation is not to follow, a modification of Schoeller's $K_2S_2O_7$–tannin method (A., 1937, 1, 99) is suitable for low [Nb]. For large amounts, preliminary pptn. of most of the Nb almost free from Ti is effected by addition of H_3BO_3 to an acid (HCl) tannin solution of the fluorides. Detailed procedure and results show this combination to be simpler than the oxalate-salicylate method and of equal accuracy. I. McA.

Microchemical detection of gold without reagents. C. DUVAL and P. FAUCONNIER (Mikrochim. Acta, 1938, **3**, 30—32).—The solution of Au salt is evaporated in a capillary (glass or Pyrex) and the residue is heated so as to embed it in molten glass. The Au spangle formed becomes visible through the magnifying effect of the glass. The limit of identification is 1 μg. in 0·05 c.c. With smaller amounts of Au down to 0·05 μg. per 0·05 c.c. a pink thread is formed. The test is independent of the acidity of the original solution. Cu is the only metal likely to interfere and this can be overcome by dilution. The method can be applied to the detection of Au in Au–Cu alloys, in photographic toning solutions, etc. L. S. T.

Micro-titration of platinum in cupellation beads.—See B., 1938, 799.

Thermal constants at high temperatures. I. Dilatometer for measurement of linear expansion coefficients. P. G. STRELKOV (Physikal. Z. Sovictunion, 1937, **12**, 23—34).—A quartz dilatometer, comprising an Abbe–Zeiss thickness meter, has been constructed for measurement of linear expansion coeffs. The oven is maintained const. to 0·01° and the temp. is measured to within 0·2°. Sources of error, such as expansion of the measuring instrument, are eliminated by null-point measurements. J. A. D.

Semi-micro sublimation apparatus. C. M. MARBERG (J. Amer. Chem. Soc., 1938, **60**, 1509—1510).—Apparatus and technique are described. E. S. H.

Combustion calorimeters. S. W. LIPIN (Z. Instrumkde., 1938, **58**, 193—207).—Four different types of combustion calorimeter have been examined experimentally and the advantages and defects of each are critically reviewed. W. R. A.

Control of humidity and construction of a constant-temperature and humidity cabinet for laboratory use. F. E. HUMPHREYS (J. Soc. Leather Trades' Chem., 1938, **22**, 224—232).—A cabinet capable of maintaining const. conditions of temp. and R.H. is described. Temp. is controlled by means of two Hg–PhMe regulators (one to operate the heating lamps and the other to control a supply of cooling H_2O), and the humidifier by means of a strip of gold-beater's skin. D. P.

High-temperature vacuum furnace for spectroscopic work. K. R. MORE (Rev. Sci. Instr. 1938, **9**, 199—200).—The furnace described, designed to attain 2000° or higher with moderate power consumption, employs a W coil heating element and works with 2·5 kw. N. M. B.

Rotary quartz compensator with large measuring range at high accuracy. A. EHRINGHAUS (Z. Krist., 1938, **98**, 394—406; cf. *ibid.*, 1931, **76**, 315).—Scope and performance of this microscope accessory comprising two suitably cut and oriented plates of equal thickness are compared with those of the Babinet wedge. I. McA.

Mechanical registration of the values measured by a polarisation spectro-photometer. L. HONTY (Z. Instrumkde., 1938, **58**, 212—213). W. R. A.

Recording photo-electric spectroradiometer, V. M. ALBERS and H. V. KNORR (J. Opt. Soc. Amer., 1938, **28**, 121—123).—The instrument is designed for absorption measurements in the visible and near infra-red regions; it consists of a quartz monochromator, photo-cell, amplifier, and recorder. A. J. E. W.

Transmission factor of a spectroradiometer. K. K. KAY and H. M. BARRETT (J. Opt. Soc. Amer.,

1937, **27**, 65—68).—In using a spectroradiometer to evaluate the radiant flux of an energy source in abs. units a spectral and a transmission correction factor must be employed. A simple method of determining the latter by means of measurements at various distances is described. N. M. B.

Polarisation phenomenon in the Hilger E_1 quartz spectrograph. J. W. Ellis and J. Kaplan (J. Opt. Soc. Amer., 1937, **27**, 94; cf. A., 1936, 1084). —An explanation of an anomaly in the observed intensity max. and min. is given. N. M. B.

Determination of the m.p. of porphyrins and other darkly-coloured substances with the use of polarised light. C. Rimington and P. Symons (Mikrochim. Acta, 1938, **3**, 4—6).—The use of polarised light with an analysing eye-piece is advantageous in determining the m.p. of porphyrins with the Kofler apparatus. L. S. T.

Limits of volumetric analysis. Use of a new micro-titration apparatus. M. Ott (Z. anal. Chem., 1938, **113**, 81—83).—The apparatus employs a colour comparator, fitted with a series of light filters to facilitate accurate observation of the end-point. The solution is stirred automatically, whilst to accelerate replacement of the solution without disturbing the stirrer the titration cell is fitted with a small siphon. The apparatus can also be used for p_H measurements and for determination of vitamins. J. W. S.

Volume formula for calculating p_H when using a simple colorimeter wedge. K. Keller (Z. anal. Chem., 1938, **113**, 8—21).—A formula is deduced for calculating the depth of colour of a solution examined in a Hellige wedge colorimeter, and is applied to study of the p_H vals. of CO_2–HCO_3' solutions. J. W. S.

Chromaticity limitations of the best physically realisable three-filter photo-electric colorimeter. J. A. van den Akker (J. Opt. Soc. Amer., 1937, **27**, 401—407).—The best physically realisable three-filter photo-electric colorimeter suffers from fundamental chromaticity limitations. Its use as a colour comparator is discussed. F. J. L.

Submarine photometer for studying the distribution of daylight in the sea. C. L. Utterback and P. M. Higgs (J. Opt. Soc. Amer., 1938, **28**, 100—102).—The instrument described is suitable for rapid measurements of both transmitted and scattered light in narrow spectral bands. A. J. E. W.

Design of monochromatic filters for the type H-3 mercury lamp. E. M. Staats (J. Opt. Soc. Amer., 1938, **28**, 112—120).—Full details are given for the design of double glass filters for isolating the Hg radiations at 365, 405, 436, 546, 578, and 1014 mμ. A. J. E. W.

Light sources for visible and ultra-violet. J. G. Winans (Rev. Sci. Instr., 1938, **9**, 203).—The two sources described are an evacuated quartz tube with external electrodes, heated with a Bunsen burner, and containing 1 c.c. of Hg, and a modified 85-watt Hg lamp. N. M. B.

Comparison of *X*-ray photographs taken with *X* and *Y* built-up films. S. Bernstein (J. Amer. Chem. Soc., 1938, **60**, 1511).—The *X*-ray photographs are independent of the contact potentials of the films (cf. A., 1938, I, 76). E. S. H.

Qualitative and quantitative study of radiation sources and photographic emulsions in the ultra-violet region. P. Gesteau (Compt. rend., 1938, **206**, 1630—1631).—The incident light intensity from a source is varied by a system of polarising prisms, one of which is rotated simultaneously with the traverse of a photographic plate registering the incident light. The thresholds of two emulsions, or the intensities of two light sources, may be compared by measuring the lengths of the blackened tracks obtained in each case. A. J. E. W.

Simple glass electrode of small capacity. J. B. Pettigrew and G. M. Wishart (Biochem. J., 1938, **32**, 1075—1077).—The capillary glass electrode described holds about 0·2 ml., has a resistance of 10—50 MΩ, and gives readings stable to within 0·2 mV. W. O. K.

Submerged electrode apparatus for spectroscopic analysis. F. Todd (J. Chem. Educ., 1938, **15**, 241—242).—In the electrode described Pt wire electrodes are placed in a solution or suspension of the substance under test. The electrodes are connected to an ordinary 110-v., 60-cycle a.c. The 31 elements tabulated give satisfactory lines for a visual qual. analysis, which can be carried out in 5—35 min. Limits of detection vary from 0·009 mg. per c.c. with Na to 5 mg. per c.c. with K. Al, As, B, C, Cs, Mo, P, Rb, S, Sb, Se, Ti, Te, U, V, and W do not give suitable lines with this electrode. L. S. T.

Detector properties of the compounds contained as inclusions in steel. J. Czochralski and W. Sznuk (Wiadom. Inst. Met., 1936, **3**, 3—4; Chem. Zentr., 1936, ii, 1979).—The radiomicroscope shows a weak detector action of the Fe and Fe Mn silicates, but not the Mn silicates, occurring as inclusions in steel. The effect is not suitable, at present, for the identification of the silicates in steel. L. S. T.

Use of alternating current mains in electrolytic analysis. A. J. Lindsey (Analyst, 1938, **63**, 425—426).—A means of obtaining d.c. sufficiently free from ripple for quant. deposition and separation of metals is described. E. C. S.

Continuous electron counter. O. Zeiller (Z. Instrumkde., 1938, **58**, 207—209).—Apparatus is described. W. R. A.

Accidental coincidences in counter circuits. C. Eckart and F. R. Shonka (Physical Rev., 1938, [ii], **53**, 752—756).—Statistical considerations are examined in relation to counter circuits. N. M. B.

Electron multiplier as an electron-counting device. Z. Bay (Nature, 1938, **141**, 1011; cf. A., 1938, I, 216).—An electron-counting device based on the secondary emission principle has been constructed. The use of liquid air to suppress thermal emission is unnecessary when thin layers of BaO on a Ni base are used as multiplying electrodes. With a ten-stage multiplier a multiplication of 10^4 is attained. The

device can be used for counting γ-rays and has a resolving power $\gg$ that of gas-filled counters. L. S. T.

Anomalous diminution of sparking electrodes. M. MASIMA (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 404—409).—Oil vapour causes anomalous diminution of Pt–Ir and Ag electrodes during discharge at const. current intensity. J. A. D.

Photo-electric current-limiting device for insulation measurements. E. B. BAKER and H. A. BOLTZ (Rev. Sci. Instr., 1938, **9**, 196—198; cf. A., 1936, 305).—The use of a saturated diode to limit the current flowing through the sample, in the event of electrical breakdown, in the measurement of small currents at high direct potentials (conductivity of liquid insulators) has the disadvantage, when used in series, of taking a considerable potential drop across it during measurements. This is obviated by the substitution of the specially designed photo-electric cell described. N. M. B.

Potentiometric measurement of extremely small voltages. I. AMDUR and H. PEARLMAN (Rev. Sci. Instr., 1938, **9**, 194—195).—The apparatus described, a combination of familiar principles, is constructed to measure d.c. e.m.f. <20 μv. accurate to 10^{-9} v. N. M. B.

Characteristics of a strong ion source. G. TIMOSHENKO (Rev. Sci. Instr., 1938, **9**, 187—194).—The construction and operating characteristics of an ion source of the capillary arc type are described. The source yields 0·4 μ-amp. of singly charged A ions, and the beam can be focussed at ion-accelerating voltages of 1000—6000 v. The source has been used in studying the controlled sputtering of metals bombarded by A ions, and the accompanying secondary electron emission. N. M. B.

Device of the automatic regulation of a current in a Shearer *X*-ray tube. H. LE CAINE (Canad. J. Res., 1938, **16**, **A**, 100—104).—The circuit and mechanism described control the leak automatically so as to maintain a steady current, switch off the high-tension, and close the leak valve when the pressure rises excessively, and restart the tube when the vac. is restored. The tube current can be adjusted within very narrow limits. T. H. G.

Use of intense and extensive magnetic fields in recent researches. A COTTON (Nuovo Cim., 1938, **15**, 23—30).—The construction of a large electromagnet giving fields up to 18,000 gauss is described. O. J. W.

Magnetic field corrections in the cyclotron. M. E. ROSE (Physical Rev., 1938, [ii], **53**, 715—719; cf. A., 1938, I, 222).—To obtain the essential homogeneity of the magnetic field so that the ions in the cyclotron may attain high energies, the correction for the decrease in the field near the edge of the pole pieces is effected by the insertion of "shims." A method of determining the dimensions of any shape of shims is given, and vals. are found for shims in the form of a ring of rectangular cross-section placed at the edge of the cyclotron chamber. N. M. B.

Laboratory magnetic separator.—See B., 1938, 807.

Weight burettes and their use. Reversible titrations. F. L. HAHN (Mikrochim. Acta, 1938, **3**, 7—12).—Three types of wt. burette are described. Increased accuracy can be attained by first titrating a sample in the usual way, then adding an excess of the reagent, and back titrating with a solution of the substance under test. The average of such a series is free from the error inherent in titrations carried out always in the same direction. L. S. T.

Metal vacuum desiccator with a glass cover. S. ORLIĆ (Arh. Hemiju, 1938, **12**, 22—25). R. T.

Metal evaporators. H. B. DE VORE (Rev. Sci. Instr., 1938, **9**, 202).—For evaporation of 0·1—1 g. of metal, and to prevent the formation of alloys with the W coil, the W is insulated with Al_2O_3 sprayed as a suspension in a cellulose nitrate binder and fired at 1700°. In the case of $<0{\cdot}1$ g. of metal, Ag is first electroplated, clamped, or wrapped around a Ni tube coaxial with the W wire; Sn and Al are allowed to form beads between a Mo coil and the insulated W filament. Ni can be evaporated similarly, or by enclosing the entire heater in a Ni tube. N. M. B.

Glass capillaries with a rectangular cross-section. H. W. LEIGHTON and N. D. SMITH (Rev. Sci. Instr., 1938, **9**, 201—202).—Two methods of preparing the capillaries by pressing the heated tube between graphite blocks with lateral restriction by means of steel spacers, and by pressing in a rectangular groove milled in a graphite plate, are described. N. M. B.

Adjustable leak valve. W. L. EDWARDS and L. R. MAXWELL (Rev. Sci. Instr., 1938, **9**, 201).—The improved needle valve described operates axially without rotation, and can accurately control a small gas flow in either direction. N. M. B.

Measurement of the flow of gases. New anemometer. F. ROHNER (Helv. Chim. Acta, 1938, **21**, 817—820).—In the instrument described the usual capillary constriction serving to convey the gas stream is replaced by a U-shaped capillary tube passing through the Hg of a manometer inserted in series in the gas line, the ends of the capillary tube being open to the gas. J. W. S.

Determination of diffusion coefficients of gases in liquids. A. RINGBOM (Z. anorg. Chem., 1938, **238**, 94—102).—Apparatus and procedure are described and data for CO_2 in H_2O at 25—40° recorded. The vals. vary with η and temp. of the H_2O approx. according to the Stokes–Einstein law. E. S. H.

Precision densimetry. B. PESCE (Gazzetta, 1938, **68**, 230—240).—Methods of measuring d by means of a pyknometer and a float, which give an accuracy of ± 1 and 0·1 μg. respectively, are described. O. J. W.

Viscosimetry.—See B., 1938, 743.

Geochemistry.

Distribution of the constituent gases and their pressures in the upper atmosphere. S. K. Mitra and H. Rakshit (Indian J. Physics, 1938, **12**, 47—62).—If the upper atm. consists of N_2 and O then the region above 250 km. will consist largely of O atoms. This does not agree with observations on high altitude auroral spectra, which show a greater intensity of the negative bands of N. Since the ionisation of the *F* region of the ionosphere persists all night it may be that the constituents of the upper atm. are N_2 and O_2. T. H. G.

Theory of molecular dissociation and fundamental mechanisms in the upper atmosphere. R. C. Majumdar (Indian J. Physics, 1938, **12**, 75—86).—A formula giving the degree of mol. dissociation under the influence of solar ultra-violet light is deduced. O_2 mols. in the air are completely dissociated at a height of 167 km. assuming a temp. of 300° K. and a mol. wt. corresponding with the average mass of the N_2 mols. The constituents and the mechanism of the fundamental processes in the ionosphere are discussed. T. H. G.

Nitrogen and argon in the earth's crust. (Lord) Rayleigh (Nature, 1938, **141**, 970; cf. A., 1938, I, 280).—Igneous rocks contain approx. 3×10^{-2} c.c. of N per g., most of which is chemically combined. The ratio of A to N is approx. $1{\cdot}3 \times 10^{-3}$, and is $<$ that of the atm. The total N content of the rocks is $\gg$ that of the atm. L. S. T.

Presence of krypton, xenon, and other noble gases in the Tuscan boraciferous soffioni. Geochemical aspects of the composition of soffioni. U. Sborgi (Mem. R. Accad. Ital., 1937, **8**, 533—558).—The pressure of Kr and of Xe in the natural gases from the soffioni has been confirmed. The concn. ratios Kr : A and Xe : A are 1·626 and 3·544 times the corresponding vals. for air. The composition of the soffioni gases is discussed from the geochemical viewpoint. O. J. W.

Analysis of the [mineral] water of S. Elena di Chianciano [Siena]. M. T. Guerritore (Annali Chim. Appl., 1938, **28**, 110—115).—Data for the chemical constituents, physico-chemical properties, and radioactivity are given. F. O. H.

Mineral water from springs in Farfa in Sabina (Rieti). M. Talenti (Annali Chim. Appl., 1938, **28**, 174—187).—Chemical, physico-chemical, and biological properties are recorded. O. J. W.

Radioactivity of the thermal waters, gases, and deposits of Yellowstone National Park. H. Schlundt and G. F. Breckenridge (Bull. Geol. Soc. Amer., 1938, **49**, 525—538).—Apparatus and methods for the examination of gases, waters, and solids are described. Data for the radioactivity of the gases, waters, and spring deposits and rock samples are tabulated. Similar data are recorded for the radioactivity of the hot springs at Thermopolis, Wyoming, and a comparison with the radioactivity of waters from different parts of the world is made. The above vals., obtained in 1936, agree with those obtained in 1906 (A., 1911, ii, 360). No correlation between radioactivity and the surface temp. of a spring or its p_H has been found. Although the radioactivity is low the amount for a long period of time is large. 33·9 g. of Ra equiv., mainly as Rn, are calc. to be discharged by Hot River during one year. The calc. amount of Ra discharged is approx. 90 mg. L. S. T.

Medical hydromineralogy of Angola. A. de Aguiar (Rev. Chim. pura appl., 1934, [iii], **9**, 1—9; Chem. Zentr., 1936, ii, 1989).—Analyses and evaluation of two waters, from Balombo and Botera, have been made. One is a thermal H_2O (50°) of small salt content, and the other, an alkaline mineral H_2O with 3·2245 g. of residue per l. L. S. T.

Study of suspended sediments in estuaries and rivers. L. Glangeaud (Compt. rend., 1938, **206**, 1667—1669).—An apparatus for collecting suspended matter from 200-l. samples of H_2O is described. A. J. E. W.

The Kaalijärv meteorite from the Estonian craters. L. J. Spencer (Min. Mag., 1938, **25**, 75—80).—The crater-lake on the island of Oesel has often been described since 1827 and many views have been expressed as to its mode of origin. The finding in 1937 of small rusted fragments of meteoritic Ni–Fe in two of the smaller associated craters now definitely proves that they are explosion craters formed when large meteorites fell. The metal shows the effects of heating; micro-analysis by M. H. Hey gave Fe 91·50, Ni 8·32%. One piece shows enclosed blebs of schreibersite surrounded by graphite. A large mass of metal found in the vicinity is artificial grey cast Fe with flakes of graphite. L. J. S.

Australites : a unique shower of glass meteorites. C. Fenner (Brit. Assoc., 1937; Min. Mag., 1938, **25**, 82—85).—A review is given of the different types of tektites and of the several theories of their origin. The similarity of type and the wide distribution of australites suggest a cosmic origin. Australites contain SiO_2 about 70, Al_2O_3 13, FeO + Fe_2O_3 6, MgO 2, CaO 3, K_2O + Na_2O 4%, and traces of Mn, Ti, Ni, and Co; ρ 2·3—2·5. L. J. S.

Number of mineral species. A. E. Fersman (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 269—272).—The no. of mineral species, within the accessible portion of the earth's crust, is >3000. This is small compared with the no. of animal or vegetable species. The no. of mineral species in different geochemical systems depends on the thermodynamic character of the system and on the lattice energy levels of the species. W. R. A.

Geochemical distribution laws of the elements. IX. Quantity ratios of the elements and the atomic species. V. M. Goldschmidt (Norske Vidensk.-Akad. Oslo, I, Mat.-Naturv. Kl., 1937, 148 pp.).—The distribution of the elements in the earth's crust, in meteorites, and in the atm. of the sun, stars, etc. is discussed. Data for the individual elements are given and geochemical conclusions reached from these data are discussed. L. S. T.

Monothermite. D. S. BELIANKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 673—676).—This constituent of Chassov-Jar and other Soviet clays is characterised by crystallo-optical data, chemical analysis, and dehydration–temp. curve. Its air-dried composition is $(0{\cdot}2MO,Al_2O_3,3SiO_2,1{\cdot}5H_2O),0{\cdot}5H_2O$, with dehydration stages at 0—100°, 400—500°, respectively. Compared with normal kaolin, the absence of exothermic behaviour at ~900° is ascribed to the function of the considerable K_2O content. I. McA.

First nepheline syenite in Transcaucasia. D. S. BELIANKIN, V. P. PETROV, and R. P. PETROV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 73—76).—The rocks are described and compositions as shown by chemical analysis are tabulated. N. M. B.

New localities of torbernite, autunite, and uraninite. S. HATA and T. IIMORI (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 355—358).—Mineralogical features and chemical analyses are recorded for specimens from Ōkuma and Ōhari, Japan. I. McA.

Fergusonite from a new locality. S. IIMORI and S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 504—507).—At Iisaka, Japan, the mineral, unusually rich in Ta, occurs in prismatic crystals of ρ 5·77, in a felspar matrix. Typical forms are listed. A chemical analysis confirms the formula $R_2O_3,(Nb,Ta)_2O_5$. I. McA.

Crystalline form of acmite. G. CESÀRO and J. MÉLON (Bull. Acad. roy. Belg., 1938, [v], **24**, 180—212; cf. A., 1937, I, 484).—A detailed analysis of external morphology from goniometric data of the authors and others is given. I. McA.

Fluorescence and phosphorescence phenomena in aragonitic calcites from Corund (Rumania). S. VON GLISZCZYNSKI and E. STOICOVICI (Z. Krist., 1938, **98**, 344—350; cf. *ibid.*, 1934, **88**, 260).—The colour and intensity of the fluorescence and phosphorescence caused by separate exposure to ultra-violet and *X*-rays have been determined for 88 varicoloured specimens from H_2O-deposited veins of ornamental calcite akin to Tecali marble. For ultra-violet excitation, intensities fall with depth of (specimen) colour, and a fleeting (0·05—0·1 sec.) red afterglow occurs with white specimens. With *X*-rays, intensities and duration of phosphorescence are smaller. The effects are possibly due to inclusions of rare earths, but not to aragonite which chemical and *X*-ray analyses show to be absent. I. McA.

***X*-Ray examination of olivenite, $Cu_2(OH)AsO_4$.** H. HERITSCH (Z. Krist., 1938, **98**, 351—353).—From rotation and powder *X*-radiograms, the rhombic cell contains 4 $Cu_2(OH)AsO_4$, with *a* 8·20, *b* 8·62, *c* 5·94 A.; $\rho_{calc.}$ 4·48. Indexed reflexions are listed. The probable space-group (D_{2h}^{1}) differs from that of $Cu_2(OH)PO_4$ (A., 1936, 1483). I. McA.

Migration of phosphoric acid during the decalcification of calcareous phosphates. L. CAYEUX (Compt. rend., 1938, **206**, 1229—1231).—Two series of observations on the Belemnitella phosphatic minerals (Paris Basin) lead to the conclusion that, in addition to the decalcification of the phosphates, there is a migration of H_3PO_4 from the decalcified portions to the residue. J. A. D.

State of crystallisation and thermomagnetic anomaly of lepidocrocite. A. MICHEL and (MLLE.) M. GALLISSOT (Compt. rend., 1938, **206**, 1252—1254; cf. A., 1935, 1063).—The anomaly in the magnetism–temp. curves of lepidocrocite is dependent on the size of the crystal aggregates. The anomaly is greatest when the crystal grains are largest and almost disappears when the grains are very fine. J. A. D.

Xenotime and zircon from Iisaka. S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 619—622).—Xenotime specimens from Iisaka contain Yt earths 51·82, SiO_2 4·32, and P_2O_5 25·38%. Complete analytical results are given. Zircon specimens contain Yt earths 10·23, $(Zr,Hf)O_2$ 39·65, SiO_2 23·00, and P_2O_5 5·30% as chief constituents. These compositions are compared with those of previous specimens. J. A. D.

Isomorphous substitutions in apatite. I. D. BORNEMAN-STARINKEVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 253—255).—The chemical formula for fluoapatite, $3Ca_3(PO_4)_2,CaF_2 = 2Ca_5O_3O_{12}F$, can be written in the general form $A_5B_3X_{13}$. To include recorded isomorphous substitution products *A* may be Ca, Sr, Ce, Mn, Na, K, C; *B*, P, As, V, C, Si, S; and *X*, F, Cl, OH, O. Two new compounds are reported as constituents of Khibin apatites, viz., $Ca_4CeP_2SiO_{12}F$ and $Ca_3CeNaP_3O_{12}F$. Analyses are given for Khibin apatites from two beds, francolite, and ellestedite; these and revised data on a pure fluoapatite are discussed. W. R. A.

Intergrowth of quartz and felspars from the pegmatite veins of Karelia. L. A. KOSSOI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 273—275).—During certain periods of vein formation, microcline and quartz can grow simultaneously. The ingrowths of quartz are usually, although not always, oriented definitely to the crystallographic elements of microcline. During growth the quantities of components may vary until all the microcline disappears and a quartz pocket is formed. Intergrowths of quartz with plagioclase relics from quartz pockets are accidental. W. R. A.

Analysis of a single crystal of cleveite from Aust-Agder [Norway]. R. BAKKEN and E. GLEDITSCH (Tids. Kjemi, 1938, **18**, 74—75).—Successive layers were stripped mechanically from the crystal and analysed. The $UO_2 : UO_3$ and Pb : (U + 0·36Th) ratios increased continuously towards the centre. The crystal was 13×10^8 years old and took 25×10^6 years to form. M. H. M. A.

Mineralogical study of decolorising earth, gumbrine, from Georgia, U.S.S.R. J. DE LAPPARENT (Ann. Off. nat. Comb. liq., 1937, **12**, 1159—1182).—The probable constitution of the earth is SiO_2 22, felspar 2, kaolinite 8, montmorillonite 61, and alkali, TiO_2, and H_2O 7%. Its properties are discussed. R. B. C.

Keilhauite, a guide mineral to the Sterling granite gneiss of Rhode Island. J. A. Young, jun. (Amer. Min., 1938, **23**, 149—152).—Keilhauite, SiO_2 29·85, TiO_2 30·65, Al_2O_3 7·32, Fe_2O_3 6·17, FeO none, MnO none, MgO none, CaO 22·37, H_2O 0·32, $Yt_2O_3 + Ce_2O_3$ 3·58, total 100·26% [analyst, F. A. Gonyer], may be used to distinguish Sterling granite gneiss from other granite gneisses of similar appearance. There appears to be a gradation in properties from keilhauite to sphene. *X*-Ray powder diagrams for Rhode Island keilhauite and for sphene from Renfrew, Canada, show identical spacing and intensity. L. S. T.

Sun-burning of rocks. J. E. Hibsch (Z. deut. geol. Ges., 1938, **90**, 17—19).—A criticism (cf. A., 1936, 1087). Sun-burning has been observed in basalts in which no glassy material is present, and it is absent in certain basalts that are rich in glassy material. An alternative explanation is provided by the unequal weathering of the layers forming a "coagulation" structure in rocks. L. S. T.

Pedocalic tendencies in soils of southern England. F. F. Kay (Nature, 1938, **141**, 925—926).—The occurrence of secondary depositions of $CaCO_3$ in or below the surface soil in the Upper Greensand and Calcareous Grit formations of Berkshire is described. L. S. T.

Differentiation of the Glen More Ring-dyke, Mull. C. Koomans and P. H. Kuenen (Geol. Mag., 1938, **75**, 145—160).—New chemical analyses and the variation diagram are given. Deviations of the latter from the Normal Magma Series is discussed. L. S. T.

Diorites and associated rocks of the Glen Tilt Complex, Perthshire. W. A. Deer (Geol. Mag., 1938, **75**, 174—184).—Descriptions and chemical analyses of a biotite-granite, a muscovite-biotite granite, four intermediate granite-diorite hybrids, two acid hybrids, and a quartz-diorite are given. L. S. T.

Asthenolith (melting spot) theory. B. Willis (Bull. Geol. Soc. Amer., 1938, **49**, 603—614).—An asthenolith is a body of magma locally melted at any time in any solid portion of the earth. Geologic effects of asthenolithic activity are discussed. L. S. T.

Dating Cretaceous-Eocene tectonic movements in Big Horn Basin by heavy minerals. M. H. Stow (Bull. Geol. Soc. Amer., 1938, **49**, 731—761).—Heavy mineral analyses are included. L. S. T.

Petrology of the contact breccias of the Chelan batholith. A. C. Waters (Bull. Geol. Soc. Amer., 1938, **49**, 763—794).—Seven chemical analyses of Chelan rocks are recorded. L. S. T.

Sylvine with uniformly deposited hæmatite. J. Leonhardt and R. Tiemeyer (Naturwiss., 1938, **26**, 410—411).—The occurrence of sylvine with hæmatite uniformly deposited on it in the Niedersachsen pit at Wathlingen is recorded and discussed. A. J. M.

Ultrahasic rocks of E. Transbaikalia. I. V. Luchizki (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 169—171).—Peridotite from a serpenitic dyke on the bank of the Sredniaya river is described and a chemical analysis recorded. L. S. T.

Average chemical composition of the Cambrian basaltic lavas of W. Siberia. V. K. Monich (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 173—175).—Chemical analyses are recorded and compared with those of related world types. Certain chemical peculiarities are pointed out. L. S. T.

Origin of some white earths from the Valle del Nestore (Umbria). P. Principi (Atti R. Accad. Lincei, 1938, [vi], **27**, 113—116).—The deposits, which have SiO_2 13·21, $CaCO_3$ 84·98, $Fe_2O_3 + Al_2O_3$ 1·42%, $MgCO_3$ traces, p_H 7·6, are described. O. J. W.

Slovakian infusorial earth. J. Matějka (Zprávy československ. keram. Spol., 1935, **12**, 14—39; Chem. Zentr., 1936, ii, 1878).—The properties and possible uses of infusorial earth from Dúbravica (SiO_2 74·16, Al_2O_3 14·14, Fe_2O_3 2·19, loss on ignition 8·13%) are described. The behaviour of the earth as an addition to mortar has also been investigated. L. S. T.

Pre-Cambrian mining areas in northern Australia. E. C. Andrews (Econ. Geol., 1938, **33**, 125—135).—Geological structures of Tennant Creek and Claudie River Au fields are described. L. S. T.

Paragenesis of pyrrhotite. R. Blanchard (Econ. Geol., 1938, **33**, 218—225).—A criticism (cf. A., 1937, I, 270). L. S. T.

Origin of primary lead ores. R. C. Wells (Econ. Geol., 1938, **33**, 216—217).—A crit. discussion (cf. A., 1938, I, 163, 283). L. S. T.

Bromyrite from Tombstone, Arizona. C. A. Rasor (Amer. Min., 1938, **23**, 157—159).—Modes of occurrence of the bromyrite, Ag 56·7, Br 38·9, I 2·6, Cl 0·6, total 98·8%, are described. L. S. T.

Presence and constitution of ferruginous concretions in a Mediterranean soil. P. Boischot and G. Drouineau (Compt. rend., 1938, **206**, 1577—1579).—A soil from the forest of Valbonne (Maritime Alps) is described, and the occurrence of numerous small balls (0·4—3 mm. diameter), containing considerably more Fe and Mn and less Al_2O_3, TiO_2, and SiO_2 than the surrounding clay, is discussed. A. J. E. W.

Changes of the water-soluble inorganic matters of mud during its keeping and preparation for analysis. N. Veselovski and M. Konarev (Hydro-Chem. Mat., 1938, **10**, 215—238).—$[SO_4'']$ and $[HCO_3']$ of the mud increase with time. J. J. B.

Soils in regions drained by [certain] lakes in the basin of West Manich. I. A. Schulga (Hydro-Chem. Mat., 1938, **10**, 29—91).—The mutual relationship between rain-H_2O, lake-H_2O, and soil is discussed. J. J. B.

Determination of refractive indices of vitrains. T. T. Quirke and L. C. McCabe (Bull. Geol. Soc. Amer., 1938, **49**, 669—681; cf. A., 1938, I, 284).—Vals. of n for various samples of vitrain have been determined with an accuracy of 0·015 from goniometric measurements of the angle of max. polarisation in reflected light. In banded coals n indicates the rank of the coal, and its approx. B.Th.U. val. on a moist mineral-matter-free basis. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

SEPTEMBER, 1938.

Emission bands in the $3p^1\Pi_{cd}$—$1s^1\Sigma$ system of the hydrogen molecule. C. R. JEPPESEN (Physical Rev., 1938, [ii], **54**, 68—71).—Previous results (cf. A., 1933, 991) are extended with the help of a new grating spectrograph to obtain the band system in emission. Data and analyses for 10 bands from the first three vibrational levels of the excited state are tabulated; rotational and vibrational consts. are derived. N. M. B.

Influence of noble gases on the intensity of lines of hydrogen and deuterium Balmer series. V. TSCHERNIAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 243—248).—The intensities of the principal lines in the Balmer series of H_2 and D_2 are discussed for discharges produced in 61% D_2O vapour, or in He, Ne, or A, with traces of H_2 or D_2 present in each case. W. R. A.

Kramers' absorption law in astrophysical problems. T. L. PAGE (Nature, 1938, **141**, 1137).—Measurements of intensities in the Balmer emission spectrum due to recombining protons and electrons in gaseous nebulæ and in an electrodeless discharge tube show that this law is invalid for H_2 and should not be used in astrophysical problems. L. S. T.

Intensity relations in the low-voltage helium arc. J. J. HEILEMANN (Physical Rev., 1938, [ii], **53**, 977—983; cf. Razek, A., 1931, 887).—The relative intensity of He spectrum lines was measured under various conditions of excitation. A linear relation was found between arc current and line intensity for a series of voltages between the excitation potential and 100 v., and from these curves excitation functions are found for currents up to 30 μ-amp. Results are discussed in relation to available data. N. M. B.

Possible presence of metastable atoms of nitrogen (^2P) in the high atmosphere. R. BERNARD (Nature, 1938, **141**, 1140).—The spectrum of diffuse auroras shows an intense sharp line at 3470·3 A., due to at. N ($^2P \rightarrow {}^4S$). The mechanism of excitation in the aurora probably includes an electronic bombardment producing the permanent radiations of the spectrum, and an afterglow giving rise to N bands $A \rightarrow X$ and to the 3470 (N I, ^2P—^4S) radiation. L. S. T.

Identification of auroral radiations. J. KAPLAN (Physical Rev., 1938, [ii], **54**, 148).—The difference between the $A^3\Sigma$—$X^1\Sigma$ spectra of solid and gaseous N_2 is emphasised with reference to erroneous collected data and indentifications published by Vegard. Comparative data are tabulated. N. M. B.

New nitrogen line. J. KAPLAN (Nature, 1938, **141**, 1139).—Further investigations of the high pressure N afterglow (A., 1938, I, 285) indicate that the 3471 line increases in intensity as the tube approaches the pure N stage. The line is closely related to the Vegard–Kaplan bands in its variations of intensity with pressure. The spectrum reproduced is a good laboratory reproduction of the light of the night sky. The results indicate that the Vegard–Kaplan bands, the 3471 line, and possibly other radiations in the light of the night sky are emitted in the lower regions (? 50 km.) of the higher atm. L. S. T.

Enhancement of the sodium *D* lines in the twilight sky light. R. BERNARD (Nature, 1938, **142**, 164; cf. A., 1938, I, 335).—Concerning priority. L. S. T.

Altitude of the atmospheric layer in which (sodium) *D* lines are emitted and the origin of sodium in this layer. G. DÉJARDIN and R. BERNARD (Compt. rend., 1938, **207**, 81—83).—Computed vals. for the altitude are discussed and reasons are given for accepting a val. <60 km. The contention of Cabannes *et al.* (A., 1938, I, 377) that the Na has its origin in meteors is criticised and a terrestrial origin is favoured. In addition to the evaporation of terrestrial H_2O, Na is ejected into the atm. during volcanic activity. W. R. A.

New types of electric arc. I. Arc between glass electrodes. M. PIERUCCI and L. BARBANTI-SILVA (Nuovo Cim., 1935, **12**, 533—540; Chem. Zentr., 1936, ii, 266).—A steady arc may be obtained between C and a glass-capped C electrode. It is struck by heating the glass and displays a continuous spectrum with reversal of the Na *D* and the Ca 4227 A. lines. H. J. E.

Spectrum of singly ionised tin. Sn II. W. W. MCCORMICK and R. A. SAWYER (Physical Rev., 1938, [ii], **54**, 71—75; cf. Lang, A., 1930, 651).—The spectrum of Sn II, excited in a hollow-cathode discharge in He, was photographed from 800 to 10,000 A. Full data including about 70 new lines with classifications are tabulated, 28 new levels are established, and previous data are corr. The classification is checked by series relations, Zeeman patterns, and by comparison with the isoelectronic spectra In I and Sb III. The ionisation potential of Sn II is 118,017±3 cm.$^{-1}$ N. M. B.

Absorption of gold and silver in the ultra-violet region. D. COSTER, S. HOF, G. RATHENAU, and C. F. E. SIMONS (Physica, 1938, **5**, 643—656).—Constructional details are given for a vac. spectro-

graph using a glass grating at normal incidence at 2 m. radius. Measured vals. of the absorption coeff. of Ag and Au at 1450—2100 A. are recorded graphically and discussed. The distribution of oscillator strength due to the *d*–*p* transition lies at lower λλ for Ag than for Au, indicating that the Ag *d*-electron is more firmly bound in the metallic state. A. J. E. W.

Gas discharges produced by triboelectricity of mercury. F. HALLA and W. RITTER (Z. tech. Physik, 1936, **17**, 44; Chem. Zentr., 1936, ii, 265—266).—The glow produced by shaking Hg in A or He at 4—7 mm. in a glass bulb is in the range 5912—3651 A. Lines due to Hg, A, and He are found. H. J. E.

Oxidation of the arc cathode. F. H. NEWMAN (Phil. Mag., 1938, [vii], **26**, 187—188).—Recently Suits and Hocker (A., 1938, I, 293) have explained the possibility of striking an arc at atm. pressure as due to formation of an oxide film on the cathode. An earlier explanation (*e.g.*, A., 1932, 1184), involving formation of cathode spots, is cited. W. R. A.

[Effect of] background effect on the density measurement of spectral lines. L. W. STROCK (Tids. Kjemi, 1938, **18**, 98—101).—Factors affecting the accuracy of spectro-photographic analyses have been studied. The increased rate of development of a narrow line over that of a continuum, due to lateral diffusion of the developer (Eberhard effect), has been proved experimentally. It cannot be eliminated by prolonged development. Evaluation of line intensities by means of blackening curves obtained for continua is thus inaccurate. The decreased rate of blackening of a line in presence of fog is due to regression of Ag electrons from *F* to *U* levels (desensitisation) on intense illumination. Intermittent exposure of an emulsion to line and continuous illumination causes a permanent decreased blackening of the line image owing to partial destruction of the latent image by the continuous illumination. Since these conditions occur during arcing, the fog effect cannot be eliminated by development to infinity. M. H. M. A.

Ionisation and recombination in the theory of stellar absorption lines and nebular luminosity. S. CHANDRASEKHAR (Astrophys. J., 1938, **87**, 476—495).—A theoretical treatment of the effect of collisions and photo-ionisations on monochromatic radiative equilibrium. L. S. T.

Transverse Doppler effect. C. J. DAVISSON (Physical Rev., 1938, [ii], **54**, 90—91).—Mathematical. The effect in relation to spectral lines and the velocity of the particles producing them is deduced on the relativistic mechanics of photon emission. N. M. B.

Silver *L* series *X*-ray spectrum : line widths, wave-lengths, relative intensities, satellites, and widths of energy levels. L. G. PARRATT (Physical Rev., 1938, [ii], **54**, 99—114).—Using a new two-crystal vac. spectrometer, full data obtained from a systematic study of 36 *L* series Ag emission lines, including 21 satellite lines, are reported and plotted. The contours of the three *L* absorption edges of Ag are recorded. Widths of all the energy levels for single ionisation of Ag are determined, and from the widths of satellite lines are derived the widths of certain states of double ionisation. N. M. B.

Spectrographic study of the electronic structure of metals. J. FARINEAU (Ann. Physique, 1938, [xi], **10**, 20—102).—The broad bands emitted by metals in the soft *X*-ray region 7—15 A. are investigated. Band theories based on the concepts of free and bound electrons are examined critically, and from the Wigner–Seitz–Slater approximations a more rigorous theory is deduced. Using a curved-crystal spectrometer, band intensity distributions for Mg, Al, and Si were measured, and deductions as to the distribution of electrons in the metal crystal are reported. The electronic structures of liquid and solid Al are compared. Results for Al–Mg alloys show that the *M* electrons are shared. Theoretical deductions from the *L* bands of Co, Ni, Cu, and Zn on the structure of the 3*d* and 4*s* bands of these metals are examined. N. M. B.

Mass absorption coefficients of water and aqueous solutions of compounds of selenium, bromine, cadmium, iodine, barium, cerium, and thallium. I. MÜLLER (Ann. Physik, 1938, [v], **32**, 625—639).—Measurements were made by the filter difference method using monochromatic *X*-rays. Results for H_2O agree with those of Küstner and Trübestein (A., 1937, I, 208). The $C\lambda^n$ law is obeyed for the elements investigated and vals. for μ_k/μ_l at the *K*-edge agree within ±4% with those of Rindfleisch (*ibid.*). O. D. S.

Accuracy of the linear law in simple cases of Zeeman effect. P. JACQUINOT (Compt. rend., 1938, **206**, 1960—1963; A., 1936, 769.)—An appreciable Paschen–Back effect is observed at 45,000 gauss for the 4680 and 4722 A. lines of Zn and for the 6334 and 6383 A. Ne lines. The linear law is obeyed to approx. 1 in 1000. No Kapitza effect is discernible at 45,000 gauss. W. R. A.

Instability of very small independent currents in gas discharges, particularly in Geiger–Müller counters. C. VAN GEEL and (FRL.) J. KERKUM (Physica, 1938, **5**, 609—618).—The occurrence in positive corona discharges of a min. current ($I_{min.}$), below which the discharge is unstable, is explained by applying probability considerations to the emission of electrons from the cathode. The results are considered in relation to experimental vals. of $I_{min.}$. A. J. E. W.

Thermionic emission from carbon. A. L. REIMANN (Proc. Physical Soc., 1938, **50**, 496—500).—Thermionic emission data for a carefully outgassed filament of graphitic C are plotted for the range 1665—2191° K. The corresponding vals. of the consts. *A* and ψ in the empirical emission formula $i = AT^2\epsilon^{-\psi/kT}$ are 30 amp./cm.^{2}-deg.^{2}, and 4·34 e.v., respectively. N. M. B.

Cascade theory of electronic showers. L. LANDAU and G. RUMER (Proc. Roy. Soc. 1938, **A**, **166**, 213—228).—A more rigorous mathematical treatment of the theories of Bhabha and Heitler and of Carlson and Oppenheimer. The no. of shower particles is calc. as a function of depth of penetration

for given initial energy of the creating particle. The showers are found to have a definite range. Their behaviour on passing from air to a medium with different at. no. is studied. G. D. P.

Energy loss of fast electrons by radiation. L. A. ARZIMOVITSCH and V. A. CHRAMOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 415—417).—Measurements are recorded for the intensity (I) of γ-radiation emitted from C, Al, Cu, Sn, and Pb on the impact of electrons of energies 600—3000 kv. There is a linear relationship between I and the at. no. of the element bombarded. H. J. E.

Scattering of fast electrons in gases. J. B. H. KUPER (Physical Rev., 1938, [ii], **53**, 993—997).—The angular distribution of elastically scattered electrons of energies 49·5—87·7 kc.v. was measured in A, Ne, and He over the range 0·3—6°. Comparison of results with the theoretical curves shows good agreement for A, and in Ne except at the smallest angles, but no agreement for He. The discrepancies are similar to those found at the smallest angles in the scattering of electrons of a few hundred v., and are probably due to polarisation of the at. field by the passing electron. N. M. B.

Calculation of the elastic scattering of electrons by molecular hydrogen. R. ROSCOE (Phil. Mag., 1938, [vii], **26**, 32—41).—An equation for the elastic cross-section for the elastic scattering of electrons by H_2 is derived using the simple Born theory. Different wave functions due to Wang, Rosen, and Weinbaum are also used to calculate the elastic cross-section. W. R. A.

Model of the electron based on the correspondence principle. H. HÖNL (Naturwiss., 1938, **26**, 408—409).—Theoretical. A model of the electron put forward on the basis of the correspondence principle, while accounting reasonably for the mass and magnetic and mechanical moments of the electron, disagrees with the usual assumptions concerning the radius of the electron. A. J. M.

Ratio of mass of electron and neutron. F. MÖGLICH (Naturwiss., 1938, **26**, 409—410).—Theoretical. A. J. M.

Exchange of energy by electron collision in inert gas discharge columns. G. MIERDEL (Wiss. Veröff. Siemens-Werken, 1938, **17**, 277—290).—A detailed account of work already partly reported (A., 1938, I, 167). The investigation is extended to He and A. A. J. M.

Process of discharge and ionic efficiency in the positive-ray discharge. C. HAILER (Wiss. Veröff. Siemens-Werken, 1938, **17**, 321—340).—A detailed account of work already reported (A., 1938, I, 222). A. J. M.

Investigation of hydrogen and helium positive rays by the mass spectroscope. W. SCHÜTZE (Wiss. Veröff. Siemens-Werken, 1938, **17**, 341—362).—The intensity distribution of H_2 and He ions in the positive ray discharge was investigated by Hailer's mass spectroscope (A., 1938, I, 222). It was found that H_2^+ and He^+ are the primary ions in the discharge. The existence of He_2^+, H_4^+, and H_3^+ has been confirmed, although H_4^+ and He_2^+ are so unstable that parabolas due to them could not be directly observed. H_3^+ ions can be produced on the walls of the discharge tube as well as by the process $H_2^+ + H_2 \rightarrow H_3^+ + H$. A. J. M.

Energy loss of positive electrons in passing through aluminium. B. R. CURTIS (Physical Rev., 1938, [ii], **53**, 986—991).—The energy loss of positive electrons of energy range 0·3—1·5 Mc.v., obtained by bombarding Fe with deuterons, was determined in a H_2-filled cloud chamber for 0·0275, 0·053, and 0·114 cm. thicknesses of Al. The vals. of the average energy loss are 0·123, 0·274, and (approx.) 0·480 Mc.v., respectively, showing progressive excess over the theoretical vals. given by Bloch's formula. A comparison of the energy lost by the negative electron with that lost by the positive electron, made with electrons from radioactive P, shows that there is no essential difference in the amount of energy lost by the two particles. N. M. B.

Influence of positive ions on the mobility of electrons in the mercury arc. W. ELENBAAS (Physica, 1938, **5**, 568—580).—The potential gradient (f) in high-pressure Hg arcs has been measured for pressures (p) $\gtrsim 2$ cm. in discharge tubes 12—38 mm. in diameter (d). The observed val. of f is $>$ the calc. val. for low vals. of p and large d; the deviation is accounted for by considering the influence of positive ions on the electron mobility. A. J. E. W.

Angular distribution of protons emitted in the process $D + D \rightarrow {}^3H + {}^1H$. H. NEUERT (Naturwiss., 1938, **26**, 429).—The variation of the angular distribution of protons emitted in the above process with energy of the colliding deuterons was determined with a proportional counter over the potential range 35—90 kv. The ratio of abundance of protons in the direction of the positive rays and perpendicular to it decreases as the energy of the deuterons decreases. A. J. M.

Upper limit of ion energy obtainable by means of the cyclotron. J. CHURGIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 237—238).—The energy of ions produced by means of the cyclotron has an upper limit. An equation is derived for the max. ion energy. The work of Bethe and Rose (A., 1938, I, 115) is criticised. W. R. A.

Velocity distribution in an atomic ray and the free path as a function of the velocity. N. SASAKI and M. FUKUDA (Proc. Imp. Acad. Tokyo, 1938, **14**, 166—169).—Theoretical. The Maxwell distribution law, and Tait's formula for the free path as a function of the velocity, are applied to a ray of Na atoms spectrally resolved by a non-homogeneous magnetic field. The calculations agree satisfactorily with experiment. A. J. M.

Technique of Stern–Gerlach experiment. O. SPECCHIA (Nuovo Cim., 1935, [ii], **12**, 541—548; Chem. Zentr., 1936, ii, 19).—An apparatus is described. J. S. A.

Moseley's law. S. BALCE (Philippine J. Sci., 1938, **65**, 143—145).—Theoretical. E. S. H.

International table of stable isotopes for 1938. F. W. ASTON, N. BOHR, O. HAHN, W. D. HARKINS,

and G. URBAIN (Union Internat. Chim., 1938, 3—14). —Advances and corrections are reported, and full data for all known isotopes are tabulated. N. M. B.

Isotopes and analytical standards. M. G. MELLON (J. Chem. Educ., 1938, **15**, 290).—Attention is directed to the analytical significance of ^1H, ^2H, and ^3H, and ^{16}O, ^{17}O, and ^{18}O with respect to at. wts., equiv. wts., and the litre. L. S. T.

Concentration of the ^{15}N isotope and some spectroscopic investigations on ^{15}N. H. KRÜGER (Naturwiss., 1938, **26**, 445).—Diffusion of a sample of N_2 containing ~1·9% of $^{15}N_2$ yielded a product containing 20% of $^{15}N_2$. Spectroscopic observations indicate that ^{15}N nucleus follows the Fermi statistics. Its mechanical moment is probably $I = \frac{1}{2}$. W. O. K.

Radioactive iodine isotopes. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], **53**, 1015).—Bombardment of Te with 8 Mc.v. deuterons gives rise to two new radioactive I isotopes of half-lives 13 hr. and 8 days. The latter is created by two mechanisms: the decay of radio-Te, and direct transmutation from stable Te, and is ^{129}I or ^{131}I. Negative electrons of 0·9 Mc.v. are emitted, and a γ-ray is also present. I irradiated with fast neutrons from a Li + deuteron source confirms a 13-day period attributed to ^{126}I. N. M. B.

Variations in the relative abundances of the isotopes of common lead from various sources. A. O. NIER (J. Amer. Chem. Soc., 1938, **60**, 1571—1576).—The relative abundances, as determined by the mass spectrograph, varied considerably in 12 samples although the at. wt. was nearly const. Isotopes 210, 209, 205, and 203 were not detected. E. S. H.

Packing fractions of bromine, chromium, nickel, and titanium. F. W. ASTON (Nature, 1938, **141**, 1096).—Using the vals. ^{12}C 12·00355 ± 0·00015 and H 1·00812 the following vals. for the packing fractions and isotopic wts. have been calc. from measurements of suitable doublets: ^{48}Ti −7·24 and 47·9652 ± 0·0008, ^{52}Cr −8·18 and 51·9575 ± 0·0008, ^{58}Ni (−8·35) and (57·9516 ± 0·0020), ^{79}Br (−7·4) and (78·9417 ± 0·0020), and ^{81}Br (−7·4) and (80·9400 ± 0·0020). Vals. in parentheses are provisional. L. S. T.

Limiting densities of gaseous oxygen and carbon dioxide. At. wt. of carbon. E. MOLES and A. ESCRIBANO (Compt. rend., 1938, **207**, 66—68).—The at. wt. of C, deduced from measurements of the limiting densities of O_2 and CO_2, is 12·0074 in accord with previous data. W. R. A.

At. wt. of europium. Analysis of europium dichloride. W. KAPFENBERGER (Z. anorg. Chem., 1938, **238**, 273—286).—From the ratios $EuCl_2$: 2Ag and $EuCl_2$: 2AgCl the at. wt. of Eu is 151·90. Details are given of a procedure for obtaining Eu material of at. wt. purity by electrolytic separation as $EuSO_4$. F. J. G.

Meteorites. Radioactivity of potassium as a means of determining the relative age of the element. H. SUESS (Naturwiss., 1938, **26**, 411—412).—The fact that the isotopic composition of elements in meteorites is the same as that of the same elements obtained from terrestrial sources indicates that both have the same origin, and provides a method of discovering whether the age of the elements is the same in both cases. Determination of the activity of K in tectites shows that the elements must have been produced at the same time as terrestrial K, assuming the half-life of ^{40}K to be $1·5 \times 10^9$ years, and the age of the terrestrial element to be $4·6 \times 10^9$ years. A. J. M.

Range and specific ionisation of α-particles. M. G. HOLLOWAY and M. S. LIVINGSTON (Physical Rev., 1938, [ii], **54**, 18—37).—A shallow ionisation chamber technique for the accurate determination of the sp. ionisation of a single Po α-particle and the range–energy relation for α-particles in the low-energy region down to zero range is reported. Various corrections are discussed, both in relation to the present method and those used by previous workers. Amendment of accepted vals. of abs. mean ranges of all α-particle groups is indicated. Vals proposed are: Th-*C'* (15° and 760 mm.) 8·570 ± 0·007; Po 3·842 ± 0·006 cm. N. M. B.

β-Transitions in a coulomb field. F. HOYLE (Proc. Roy. Soc., 1938, **A**, **166**, 249—269).—The assumption that a neutron can transform into a proton with the emission of an election and a neutrino is subjected to analysis. "Forbidden" transitions and modifications of the electron energy spectra are discussed. G. D. P.

(A) **Measurements of γ-ray ionisation currents in air at high pressures and high gradients.** (B) **Analysis by Zanstra's adaptation of Jaffé's columnar theory.** J. W. BROXON and G. T. MERIDETH (Physical Rev., 1938, [ii], **54**, 1—9, 9—17). —(A) Results are plotted for measurements, with weak sources of γ-rays, of ionisation currents in air at pressures 20—200 atm. with collecting fields <1 v. to 4500 v. per cm. At all pressures ionisation currents rise with increase of collecting field, but, for a particular field intensity, do not continue to increase with pressure but have a max. val. in the neighbourhood of 140 atm. Rates of collection of negative ions were under all conditions > for positive ions under the same conditions.

(B) A brief survey of theoretical explanations of the characteristics of high-pressure ionisation currents is given. Measurements analysed by the Zanstra–Jaffé equation gave curves which showed small departures from linearity. Saturation current vals. were obtained by extrapolation, and varied linearly with air density over certain pressure ranges, as found by Clay and van Tijn. Modification of Clay's "wall" radiation theory at very high pressures is indicated. N. M. B.

Probability of creation of pairs in krypton by γ-rays. L. V. GROSCHEV and I. M. FRANK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 419—422).—Most of the pairs arising from the γ-radiation of Th-*C''* were due to photons of energy 2620 e.v. The effective cross-section of Kr for pair formation, calc. from the ratio of the no. of pairs to the no. of Compton electrons, is $0·50 \times 10^{-24}$ sq. cm. H. J. E.

Intensity of γ-radiation produced by slow neutrons. R. D. HILL and A. A. TOWNSEND (Proc. Physical Soc., 1938, **50**, 534—539).—Intensities of γ-rays produced by absorption of slow neutrons were measured for Cl, V, Fe, Cu, As, Ag, Cd, Sn, Sb, I, and Hg. Results for thermal neutrons are used to calculate p, the probability of production of a γ-ray quantum by an absorbed neutron. The vals. of p lie, in general, close to unity (the val. assumed for Cd); this is discussed in relation to the abs. magnitude of p, and it is probable that p is $\not<\sim 5$ for the elements investigated. Measurements of the γ-ray intensities as a function of the thickness of Ag, Cl, and Hg lead to approx. determinations of the absorption coeffs. of thermal neutrons. The relative cross-sections for γ-ray production were found from the γ-ray intensities for slow neutrons of > thermal energies. N. M. B.

Absorption of slow neutrons. III. E. AMALDI and E. FERMI (Ric. Sci. Progr. tecn. Econ. naz., 1936, [ii], **7**, I, 56—59; Chem. Zentr., 1936, ii, 742—743; cf. A., 1937, I, 58, 161).—Theoretical. The origin of the various neutron groups and their probabilities of absorption and interconversion are discussed. H. J. E.

Excitation of nitrogen nuclei by rapid neutrons passing through paraffin. J. THIBAUD and P. COMPARAT (Compt. rend., 1938, **206**, 1963—1965).—The observation that the no. of disintegrations in the reaction $^{14}_{7}N + ^{1}_{0}n \rightarrow ^{11}_{5}B + ^{4}_{2}He$ varies periodically with the thickness of the material traversed by the neutrons has been confirmed. The diminution of disintegrations is smaller with paraffin than with Pb. Successive max. have been observed as the thickness is varied; there is no change in the position or intensity of these max. when a 0·5-mm. Cd screen is interposed between the paraffin and the ionisation chamber. Variation in the energy of the neutrons alters the position and intensity of the max. W. R. A.

Angular distribution of slow neutrons from a paraffin source. J. G. HOFFMAN and M. S. LIVINGSTON (Physical Rev., 1938, [ii], **53**, 1020—1021).—Experiments show that the distribution agrees to within experimental error with that predicted theoretically by Fermi. N. M. B.

Scattering of neutrons by deuterons. P. G. KRUGER, W. E. SHOUPP, R. E. WATSON, and F. W. STALLMANN (Physical Rev., 1938, [ii], **53**, 1014; cf. A., 1938, I, 6).—The angular distribution of 328 selected tracks of recoil deuterons in an expansion chamber containing D_2, A, N_2, and D_2O vapour bombarded with 2·6 Me.v. neutrons was investigated. Results indicate a marked deviation from spherically symmetrical scattering and various explanations are discussed. The range of a recoil deuteron at 0° scattering angle has been calc., and this leads to the val. $Q = 3{\cdot}40 \pm 0{\cdot}10$ Me.v. for the disintegration energy in the reaction $^{2}_{1}D + ^{2}_{1}D \rightarrow ^{3}_{2}He + ^{1}_{0}n + Q$. N. M. B.

Excited state of the ^3H nucleus. F. E. MYERS and L. M. LANGER (Physical Rev., 1938, [ii], **54**, 90).—An unsuccessful search for an excited state formed in the reaction $^2H + ^2H \rightarrow ^3H + ^1H$, by seeking a lower-energy group of protons in this reaction, is described. N. M. B.

Asymmetric distribution of protons from deuteron–deuteron reaction. A. ELLETT and R. D. HUNTOON (Physical Rev., 1938, [ii], **54**, 87).—The distribution is not symmetric with respect to a plane perpendicular to the direction of incident deuterons. More protons are ejected backwards than forwards; the asymmetry is perceptible at 200 kv. and rises to 13% at 350 kv. Expressions for the observed distribution are given. N. M. B.

(A) Excitation function for the disintegration of ^7Li under bombardment by low-energy protons. (B) Stopping power of lithium for low-energy protons. L. J. HAWORTH and L. D. P. KING (Physical Rev., 1938, [ii], **54**, 38—47, 48—50).—(A) The investigations of Heydenburg *et al.* (cf. A., 1936, 264) are extended by accurate measurements of the yields of 8-cm. α-particles from thick and thin Li films bombarded by homogeneous beams of protons in the energy range 38—210 kv., and vals. corresponding with infinitesimal thickness are deduced, thus allowing a relative calculation of the excitation function. From available data for the stopping power the abs. cross-section of the Li nucleus for this process is calc. approx. as a function of the energy. The curves are extended to 400 kv. by applying corrections to data of Herb *et al.* (A., 1935, 1186).

(B) From the data reported above, the stopping power of Li for protons as a function of energy is calc. in the energy range 35—400 kv. The range–energy curve is obtained by integration of the reciprocals of the stopping power. N. M. B.

Accurate determination of the range–distribution curve of the radioactive α-particles from ^8Li. C. L. SMITH and W. Y. CHANG (Proc. Roy. Soc., 1938, **A**, **166**, 415—424).—For α-particles with ranges between 0·68 and 5 cm. Li_2O targets were bombarded by a deuteron beam of 550 kv. energy, a beam of 10^6 v. being used for ranges from 5 to 6·95 cm. The distribution is continuous and there is a linear relation between log no. of α-particles and their range. Upper and lower limits for the mass of ^8Li are found to be 8·0253 and 8·0246. G. D. P.

Radioactivity of ^7Be. R. B. ROBERTS, N. P. HEYDENBURG, and G. L. LOCHER (Physical Rev., 1938, [ii], **53**, 1016).—Evidence for the formation of ^7Be in the reaction $^6Li + ^2H \rightarrow ^7Be + ^1_0n$ has been obtained. Li targets bombarded with deuterons have a 43-day γ-ray activity originating in K electron capture by ^7Be. A long-period γ-ray activity from a B_4C target bombarded with 11 μ-amp. hr. of 950-kv. protons is also attributed to ^7Be. The probable energy of the radiation is 425 ± 25 kv. The reactions are discussed in detail and mechanisms are proposed. N. M. B.

Preparation of radio-element $^{32}_{15}P$ by means of an electric field. J. GOVAERTS (Nature, 1938, **141**, 1103).—The coloration and increase in wt. of 3·7 mg. of the electrode reported previously (A., 1938, I, 339) cannot be due to the radio-P. L. S. T.

Radioactive isotopes of iron. J. J. LIVINGOOD and G. T. Seaborg (Physical Rev., 1938, [ii], **54**,

51—55; cf. A., 1937, I, 490).—Radioactive ^{59}Fe (47±3 days) was produced through the reactions ^{58}Fe$(d,p)^{59}$Fe and ^{59}Co$(n,p)^{59}$Fe. Negative electrons are emitted, mainly of range 0·09 and a few extending to 0·35 g. per sq. cm. Al. The γ-ray shows a half-thickness of 10 g. per sq. cm. Pb. Radioactive ^{53}Fe is formed by the two processes ^{51}Fe$(n,2n)^{53}$Fe and ^{50}Cr$(\alpha,n)^{53}$Fe; positrons of half-life 8·9±0·2 min. are ejected. No subsequent decay of ^{53}Mn to ^{53}Cr was observed. Attempts to produce ^{55}Fe by all likely combinations of bombardment gave no result. N. M. B.

Radioactive arsenic isotopes. R. Sagane, S. Kojima, and M. Ikawa (Physical Rev., 1938, [ii], **54**, 149—150).—Ge activated with 5·5 Me.v. deuterons gives periods of 17 and 50 days approx. The processes are probably $^{73}Ge + {}^{2}D \rightarrow {}^{74}As + {}^{1}n$, and $^{76}Ge + {}^{2}D \rightarrow {}^{77}As + {}^{1}n$. Decay data are plotted and discussed. N. M. B.

Long-lived radioactive silver. J. J. Livingood and G. T. Seaborg (Physical Rev., 1938, [ii], **54**, 88).—The val. obtained by observations over a year for the half-life of the neutron-induced activity is 225±20 days. N. M. B.

Determination of the [life] periods of radioactive silver isotopes. A. Moussa and (Mlle.) H. Laurent (J. Phys. Radium, 1938, [vii], **9**, 245—250).—A more detailed account of work already noted (A., 1938, I, 289). W. R. A.

New transformation product with long life in the trans-uranium series. O. Hahn, L. Meitner, and F. Strassmann (Naturwiss., 1938, **26**, 475—476).—Analysis of the products of irradiating U with neutrons for some months indicates the existence of a new transformation product of half-life 60 days. It probably belongs to the eka-Ir series. A. J. M.

Excitation of nuclei by bombardment with charged particles. V. F. Weisskopf (Physical Rev., 1938, [ii], **53**, 1018).—Mathematical. Cross-sections are examined. N. M. B.

Dependence of nuclear photo-effect on wavelength, according to determinations with bromine and copper. W. Bothe and W. Gentner (Naturwiss., 1938, **26**, 517).—γ-Rays obtained by bombardment of B with protons produce activity in Br. The same three radioactive isotopes are obtained as when γ-rays from Li and protons are used. If irradiated to saturation the ratio of activities of the two isomeric ^{80}Br nuclei is ^{80}Br (18 min.)/^{80}Br (4·5 hr.) = 0·9 with Li γ-rays and 2·6 with B γ-rays. For Cu comparison of the effective cross-sections was made for both radiations, the primary γ-rays and the emitted β-rays being determined with counter tubes. The effective cross-section for the Li γ-rays is approx. 2·3 times that for the B γ-rays. A. J. M.

Photon emission of a black body. A. E. Haas (J. Opt. Soc. Amer., 1938, **28**, 167).—The total no. of photons emitted by a black body in thermodynamic equilibrium is $1{\cdot}5 \times 10^{11} \times T^3$ per sec. per sq. cm., where T is abs. temp. O. D. S.

Heavy electrons and β-decay. F. L. Arnot (Physical Rev., 1938, [ii], **53**, 1018—1019).—It is suggested that the heavy electron is formed from an electron and a "heavy neutrino" of mass 136 and spin ½, and if it disintegrated while still close enough to the nucleus to interact with it the continuous energy distribution of the β-rays would be qualitatively accounted for. Calculations are made as to whether its greater velocity in cosmic rays would increase its time of dissociation sufficiently to enable it to be observed as reported. This would be possible if the interaction with the nucleus caused the slower β-ray heavy electron to be dissociated in a shorter time than its time of spontaneous disintegration, and may explain some anomalous β-particle tracks reported by Crane (cf. A., 1938, I, 168) and Zwicky (*ibid.*, 292). The hypothesis of an Eddington neutral particle and an electron forming a heavy electron is discussed. N. M. B.

Transmutations of the cosmic-ray electrons and the nuclear forces. I. Tamm (Physical Rev., 1938, [ii], **53**, 1016—1017).—Mathematical. Mechanisms for the changes in the rest mass of electrons in relation to the passage of cosmic rays through the atm. are examined. N. M. B.

Transition effects of cosmic rays in the atmosphere. H. Snyder (Physical Rev., 1938, [ii], **53**, 960—965; cf. Carlson, A., 1937, I, 213).—Mathematical. An improved treatment of the multiplication and absorption of cosmic-ray electrons and γ-rays in the atm. is given. N. M. B.

Multiplicative theory of showers as applied to large bursts of cosmic-ray ionisation. C. G. Montgomery and D. D. Montgomery (Physical Rev., 1938, [ii], **53**, 955—959).—In order to decide between the multiplicative theory and a Heisenberg process in the case of large showers, calculations are made on the incident energy spectrum of electrons and photons on a small thickness of material, and hence the no. and frequency distribution of large bursts for large thicknesses. Results indicate that the multiplicative process is satisfactory when account is taken of the effect of fluctuations. N. M. B.

Large atmospheric cosmic showers containing ultra-penetrating particles. P. Auger, R. Maze, and (Mme.) T. Grivet-Meyer (Compt. rend., 1938, **206**, 1721—1723).—The occurrence of cosmic showers affecting large areas (25 sq. m.) at ground level has been investigated by the coincidence method. Showers have been observed containing ~1000 particles, an appreciable proportion of which penetrate 15 cm. of Pb; this represents a total energy per shower of $\sim 10^{11}$ e.v. These observations indicate that the penetrating component of cosmic rays is of secondary origin. A. J. E. W.

Energy loss of penetrating cosmic-ray particles in copper. J. G. Wilson (Proc. Roy. Soc., 1938, **A**, **166**, 482—501).—The cloud chamber method is used to measure the energy loss of cosmic-ray particles in a Cu plate and the results are compared with those previously obtained from Pb (Blackett, A., 1938, I, 340). In both cases there is a max. loss at an energy of $\sim 1{\cdot}5 \times 10^9$ e.v. which is not accompanied by the secondary particles to be expected if it were due to the emission of collision radiation. It is

suggested that this type of absorption may be responsible for the anomaly in the sea-level energy spectrum of cosmic rays at $2{\cdot}5 \times 10^9$ e.v. G. D. P.

Showers produced by the penetrating cosmic radiation. W. HEITLER (Proc. Roy. Soc., 1938, **A, 166**, 529—543).—The assumption that a proton (or neutron) transforms into a neutron (or proton) with the emission of a heavy positive (or negative) electron is applied to the passage of a heavy electron through matter. A no. of cosmic ray facts are explained, and the theory indicates the existence of several types of showers. G. D. P.

Production of secondary electrons by cosmic-ray particles. J. G. WILSON (Nature, 1938, **142**, 73).—From the no. and energy of secondary electrons produced by the more penetrating cosmic-ray particles traversing a 2-cm. Au plate, and using Bhabha calculations (A., 1938, I, 291), it is concluded that the observed no. of secondary electrons can be explained by the elastic collisions of the penetrating rays with electrons, assuming that the former have a mass somewhat >100 times that of the electron. L. S. T.

Cosmic-ray particles of intermediate mass. S. H. NEDDERMEYER and C. D. ANDERSON (Physical Rev., 1938, [ii], **54**, 88—89).—A preliminary discussion is given of a photograph of a positively charged particle track which cannot be due to a particle of electronic or protonic mass. N. M. B.

Neutral particles in cosmic radiation. N. ARLEY and W. HEITLER (Nature, 1938, **142**, 158—159).—The non-ionising penetrating radiation capable of producing cosmic-ray secondaries and showers is regarded as the neutral counterpart of the heavy electron. The name " neutretto " is proposed for it. The properties of the neutretto to be expected from recent theories of nuclear forces are discussed. L. S. T.

Sidereal time variation of cosmic radiation. H. ALFVÉN (Physical Rev., 1938, [ii], **54**, 97—98).—Calculations show that the high degree of isotropy of cosmic radiation is a necessary consequence of the fact that it consists mainly of charged particles and gives no information as to place of origin. N. M. B.

Solar diurnal variation of cosmic-ray intensity as a function of latitude. J. L. THOMPSON (Physical Rev., 1938, [ii], **54**, 93—96).—An analysis of data obtained on the Pacific ocean. N. M. B.

Intensity distribution of cosmic rays. P. L. SARTORELLI (Atti R. Ist. Veneto Sci., 1936, **95**, II, 251—262; Chem. Zentr., 1936, ii, 1300).—Discrepancies between observed and calc. vals. are discussed. L. S. T.

Angular distribution of cosmic rays. R. C. GHOSH (Trans. Bose Res. Inst., 1935—1936, **11**, 159—175).—A directional survey of cosmic-ray intensity has been made at Calcutta and Darjeeling (altitudes and geomagnetic latitudes 70 ft., 23°; 7100 ft., 27°, respectively). In confirmation of other workers (*e.g.*, A., 1935, 1297), for equal zenith angles, the intensities from West and South are greater, increasingly with altitude, than those from East and North, respectively. I. McA.

Cosmic rays. Experiments in Peru. S. A. KORFF (Bol. Soc. Quim. Perú, 1935, **1**, No. 3, 6—28; Chem. Zentr., 1936, ii, 746).—Results are described. H. J. E.

Specific ionisation of gases by soft cosmic rays. Residual currents and deep-water measurements. S. SZCZENIOWSKI, S. ZIEMECKI, and K. NARKIEWICZ-JODKO (Nature, 1938, **142**, 208).—Measurements of ionisation by cosmic rays between 6 and 10 km. (balloon) using ionisation chambers filled under pressure with N_2 or Kr (+5% Xe) show that the intensity of ionisation $\propto$ gas density. The absence in the atm. of radioactive substances of extra-terrestrial origin is indicated. Anomalies found by previous workers in deep H_2O (900 m.) (A., 1934, 471) are believed to be due to residual currents and not to cosmic rays. L. S. T.

Formation of helium molecules. F. L. ARNOT and M. B. M'EWEN (Proc. Roy. Soc., 1938, **A, 166**, 543—551).—By use of the balanced space-charge method it is shown that in He mol. ionisation sets in at the resonance potential. The ions are formed by the attachment of metastable atoms to normal atoms. The results are compared with those previously obtained for Hg (cf. A., 1938, I, 344). No evidence for mol. ionisation was found in A and Ne. G. D. P.

Excited state of ^{3}He. L. I. SCHIFF (Physical Rev., 1938, [ii], **54**, 92).—Mathematical. Energy calculations do not support the existence of an excited state 1·9 Mc.v. above the ground state, as reported by Bonner (cf. A., 1938, I, 339). N. M. B.

Resonance in nuclear photo-effects. N. BOHR (Nature, 1938, **141**, 1096—1097).—An amplification of a previous communication (A., 1938, I, 171). L. S. T.

Quantum theory of Einstein-Bose particles and nuclear interaction. N. KEMMER (Proc. Roy. Soc., 1938, **A, 166**, 127—153).—A mathematical investigation shows that there are four possibilities of formulating a field theory of Einstein-Bose particles in which a positive expression for the energy density exists. Any of these might be taken as a description of the heavy electron. Consideration of the proton-neutron potential shows that only one of the four cases agrees with reality. G. D. P.

Force of interaction in electrodynamics and in the field theory of nuclear force. II, III. E. C. G. STUECKELBERG (Helv. Phys. Acta, 1938, **11**, 299—328).—Theoretical. A. J. M.

Nuclear forces and the magnetic moments of the neutron and the proton. H. FRÖHLICH, W. HEITLER, and N. KEMMER (Proc. Roy. Soc., 1938, **A, 166**, 154—177).—The assumption that the proton and neutron are capable of transformation with the emission of a positive or negative " heavy electron " is investigated. The mass of the heavy electron is shown to be about 100 electron masses. The neutron-proton force, proton-proton force, and magnetic moments of proton and neutron are calc. G. D. P.

Mechanical determination of the constitution of the nuclei of all atoms. A. VÉRONNET (Compt.

rend., 1938, **207**, 42—44).—The nuclei of all elements and their stable isotopes can be built up from D^+ and $^3H^+$. W. R. A.

Theory of the neutral particle. W. H. FURRY (Physical Rev., 1938, [ii], **54**, 56—67).—Mathematical. The elimination of the negative energy states in the case of a free particle is examined. N. M. B.

Stability of nuclear isomers. M. H. HEBB and G. E. UHLENBECK (Physica, 1938, **5**, 605—608).—Theoretical. It is shown that considerable internal conversion of γ-rays may occur in nuclear transitions where the change in angular momentum is large and the energy change is small. Consequently the life-period of a nuclear isomer capable of transition to a lower isomer is $\ll$ the life-period referred to γ-radiation alone, and the transition usually involves emission of a conversion electron, and not of γ-radiation. A. J. E. W.

Atomic nuclei of high activation. L. GOLDSTEIN (J. Phys. Radium, 1938, [vii], **9**, 262—272).—Mathematical. The conditions under which > 1 heavy particle (proton or neutron) can be emitted from at. nuclei are discussed. W. R. A.

Mechanism of the activation of atomic nuclei. L. GOLDSTEIN (Compt. rend., 1938, **206**, 1880—1882).—Theoretical. A. J. E. W.

Defect problem and transmutation of the elements. H. LIEB (Österr. Chem.-Ztg., 1938, **41**, 267—272).—A memorial review of the work of Jovičić on electrosynthesis. A. J. M.

Materialisation of a photon in the field of an electron. A. M. DA SILVA (Compt. rend., 1938, **206**, 1365—1367).—A "triple fork" having its origin in a Pb screen, and attributed to materialisation of a photon (cf. A., 1934, 6), has been observed using a Wilson cloud chamber and a Th-*C*″ photon source. The fork corresponds with the production of a positron and two electrons possessing energies of 326, 223, and 713 e.kv., respectively; these energies are in agreement with theory. A. J. E. W.

Mean distribution of electrons in a complex atom. A. DATZEFF (Compt. rend., 1938, **206**, 1359—1361).—Theoretical. A. J. E. W.

Internal conversion of arbitrary multipole order. S. M. DANCOFF and P. MORRISON (Physical Rev., 1938, [ii], **54**, 149).—Mathematical. The internal conversion of γ-radiation from other than an electric dipole is examined with special reference to the results observed for Zn by Alvarez (cf. A., 1938, I, 290). N. M. B.

Theory of excitation functions on the basis of the many-body model. E. J. KONOPINSKI and H. A. BETHE (Physical Rev., 1938, [ii], **54**, 130—138).—Mathematical. Comparison with experiment is made. N. M. B.

Investigation of chemical binding by Fourier analysis. II. H. G. GRIMM, R. BRILL, C. HERMANN, and C. PETERS (Naturwiss., 1938, **26**, 479—480).—Work previously recorded (A., 1938, I, 124) has been extended to the metallic binding, Mg being taken as an example. A three-dimensional Fourier analysis has to be carried out. The electron density falls rapidly with distance from the centre of gravity of the atom to a fairly const. val. of 0·1 electron per A.^{3} It may be concluded that there are 2 conductivity electrons in Mg which, in general, take up no predetermined place in the lattice. The remaining 10 electrons take up about 13% of the total vol. A. J. M.

Theory of relatively degenerate corpuscular gases and their use in the atomic theory of Brownian molecular movement. M. SATO (Sci. Rep. Tôhoku, 1938, **26**, 429—432; cf. A., 1936, 660). C. M. A.

Nuclear impulse in pair creation. L. V. GROSCHEV and I. M. FRANK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 239—242).—The impulse transmitted to the nucleus during pair production in Kr by γ-rays from Th-*C*″ is considered (cf. A., 1938, I, 380). W. R. A.

Study of the interaction between a photon and an electron by wave-mechanics. J. GÉHÉNIAU (Compt. rend., 1938, **206**, 1711—1713).—Mathematical. A. J. E. W.

New neutron–proton interaction potential. R. G. SACHS and M. GOEPPERT-MAYER (Physical Rev., 1938, [ii], **53**, 991—993).—On the basis of a suggested form of neutron–proton interaction potential, calculations for the deuteron and for the scattering of neutrons by protons are made. N. M. B.

Saturation requirements of nuclear forces. G. BREIT and E. WIGNER (Physical Rev., 1938, [ii], **53**, 998—1003).—Mathematical. The inequalities between the coeffs. representing the proportions of Majorana, Heisenberg, Bartlett, and ordinary interactions in the symmetric Hamiltonian, arising from considerations of saturation and of instability of odd–odd nuclei heavier than ^{14}N, are examined. N. M. B.

Dispersion formula for nuclear reactions. P. L. KAPUR and R. PEIERLS (Proc. Roy. Soc., 1938, **A, 166**, 277—295).—A mathematical investigation shows that the formula of Bethe and Placzek holds rigorously if the widths of all virtual levels which contribute essentially to the expression are $\ll$ the distances between the levels. G. D. P.

Application of the self-consistent field method to atomic nuclei. M. MATRICON (Compt. rend., 1938, **206**, 1809—1812).—Theoretical. The application of the method to the He nucleus gives a val. of the linking energy (−53·26) in better agreement with the abs. val. than the val. calc. by the Ritz–Heisenberg method. A. J. E. W.

Self-consistent field for exchange for potassium and argon. D. R. HARTREE and W. HARTREE (Proc. Roy. Soc., 1938, **A, 166**, 450—464).—The wave functions of K^+ and A are calc. by a method of interpolation from the known results for Cl^- and Ca^{++}. The results are tabulated and the vals. of the diamagnetic susceptibilities are calc. and compared with those observed. G. D. P.

Theory of heavy electrons and nuclear forces. H. J. BHABHA (Proc. Roy. Soc., 1938, **A, 166**, 501—528).—A mathematical development of the idea that the proton and the neutron are two states of the same

particle, the change from one state to the other being accompanied by the emission of a charged particle with a mass intermediate between that of the proton and the electron. The theory indicates a mass of ~200 × electronic mass and leads to showers consisting mainly of heavy electrons, with a few electrons and heavy particles. G. D. P.

Application of "reciprocity" to nuclei. M. Born (Proc. Roy. Soc., 1938, **A**, **166**, 552—553).—The formula for the distribution of quantum states is applied to some properties of nuclei. The mass of a particle moving with the velocity of light and max. momentum is ~200 × mass of the electron. G. D. P.

Waves associated with moving corpuscles. W. E. Benham (Nature, 1938, **142**, 160).—Theoretical. L. S. T.

[Most probable values for the electron charge and related constants for 1938.] R. A. Millikan (Ann. Physik, 1938, [v], **32**, 520).—The val. for N is corr. to $(6{\cdot}031 \pm 0{\cdot}006) \times 10^{23}$ (cf. A., 1938, I, 287). O. D. S.

Viscosity of air and the electronic charge. H. R. Robinson (Nature, 1938, **142**, 159—160; cf. A., 1938, I, 393).—Vals. of e obtained by combining recent vals. of η for air with the three independent series of measurements on oil drops now available are tabulated. When the most recent three measurements of η are used, Millikan's oil-drop measurements give a val. of $4{\cdot}803 \times 10^{-10}$ e.s.u. for e, in exact agreement with the X-ray val. Because of the difficulties and uncertainties in its application the oil-drop method appears to be unsuitable for the exact determination of e. L. S. T.

Atomic and ionic radii. I. Numerical values and their bearing on the compressibilities of metals. W. Hume-Rothery and G. V. Raynor (Phil. Mag., 1938, [vii], **26**, 129—143).—Metals are of two types, "open" and "full." In an open metal the ionic radius (I) is small compared with the interat. distances (II) whilst in a full metal (I) $\simeq$ (II) because ionic radii are relatively large and the ions overlap. The alkali metals are typical of the open type and Cu, Ag, and Au of the full type. After each alkali metal both (I) and (II) decrease but (I) < (II); consequently the metals succeeding an alkali metal have a less open structure. For metals succeeding Cu and Ag the decrease of (I) is > that of (II). If these ideas are correct there should be a difference between the compressibilities, c, of the open and full types. In open-type metals the properties will be controlled by the valency electrons and these may be treated as particles of an electron gas. The valency electrons spend most of their time outside the ion and it is shown that c should be approx. $(V_{ex}/N)^{5/3}$, where V_{ex} is the extra-ionic vol. in the unit cell of the crystal and N is the no. of valency electrons in the unit cell. The alkali metals (open) show this relationship approx. With full metals c is small. From this relationship it is deduced that Pb and Tl in the metallic crystals more probably correspond with $Pb^{\cdot\cdot}$ and $Tl^{\cdot}$ than with $Pb^{\cdot\cdot\cdot\cdot}$ and $Tl^{\cdot\cdot\cdot}$. The following elements and their different ionic forms are discussed: Li, Be, Na, Mg, Al, Si, K, Ca, Cu, Zn, Ga, Ge, As, Se, Rb, Sr, Ag, Cd, In, Sn, Sb, Cs, Ba, Au, Hg, Tl, Pb. W. R. A.

Relation between the electronic radius and the Compton wave-length of the proton. A. E. Haas (Science, 1938, **87**, 585).—The ratio radius of the electron : Compton λ of the proton is $3/\sqrt{2}$. It is concluded that in the equilibrium state of the universe one third of its primordial particles are protons, one third electrons, and one third neutrons. L. S. T.

Connexion between universal physical constants. H. Ertel (Naturwiss., 1938, **26**, 463).—Theoretical. A. J. M.

Action of gases on the photogenic reactions accompanying the pyrolysis of sodium azide. R. Audubert and J. Mattler (Compt. rend., 1938, **206**, 1639—1641; cf. A., 1938, I, 294).—The ultra-violet emission during pyrolysis is considerably increased by circulating N_2, O_2, or H_2 over the NaN_3. This is probably due to the removal of Na from the reaction zone, Na atoms inhibiting the excitation of N_2 mols. by the energy of activation. A. J. E. W.

Emission bands of $SiCl_2$ and $SnCl_2$. R. K. Asundi, M. Karim, and R. Samuel (Proc. Physical Soc., 1938, **50**, 581—598).—A discharge through flowing vapour of $SiCl_4$, $SnCl_4$, and $SnCl_2$ shows regions of selective continuous emission and several sets of new broad and diffuse bands differing in character and in mode of production from known SiCl and SnCl bands. They are attributed to the triat. mols. $SiCl_2$ and $SnCl_2$, and an analysis on this assumption reveals two excited electronic levels of $SiCl_2$ ($\nu\nu = 28{,}295$ and 29,952) and one of $SnCl_2$ ($\nu = 22{,}237$). Consts. and excitation energies are evaluated. N. M. B.

Spectra of the monochlorides of nickel, cobalt, and iron. K. R. More (Physical Rev., 1938, [ii], **54**, 122—125).—Emission spectra in the region 3800—6000 A., attributed to NiCl, CoCl, and FeCl, have been excited by means of high-frequency discharges in SiO_2 tubes containing $NiCl_2$, $CoCl_2$, and $FeCl_2$, respectively. Vibrational analyses of four systems of NiCl and three systems of CoCl are given. The FeCl bands showed no regularities. N. M. B.

Flame spectra of aliphatic halides. II. Ethyl bromide. W. M. Vaidya (Proc. Indian Acad. Sci., 1938, **7**, **A**, 321—326; cf. A., 1938, I, 10).—Bands due apparently to BrO are described. A large no. of bands in the yellow-orange are attributed to Br_2. E. S. H.

Spectrum of thallium chloride. H. G. Howell and N. Coulson (Proc. Roy. Soc., 1938, **A**, **166**, 238—249).—Absorption and emission spectra have been studied in the region $\lambda = 1900$—9000 A. Continua and diffuse bands and a discrete band system have been found in absorption in the region 2500—3500 A. The band system also occurs in emission. An analysis of the system is given and the classification of the bands is tabulated. G. D. P.

Electron affinity of water. A. K. Dutta (Trans. Bose Res. Inst., 1935—1936, **11**, 153—158; cf. A., 1937, I, 391).—The ultra-violet absorption spectrum of H_2O subjected to a spark between electrodes of

pure Cu, Ag, Fe, Zn, Cd, and Bi has been examined. General absorption at longer λλ, increasing with the duration of the spark and removable (Cu) on ultra-filtration, is due to disseminated material. With Cu, Ag, and Fe, selective absorption also appears at λ 2600 A. From the agreement of the corresponding energy (107 kg.-cal.) with previous results from aq. solutions of alkali halides, this band is tentatively ascribed to the electron affinity of H_2O. I. McA.

Continuous absorption spectrum of iodine monochloride in the ultra-violet. J. L. BINDER (Physical Rev., 1938, [ii], **54**, 114—117).—The absorption of light in ICl gas follows Beer's law for the concns. investigated ($> 4 \times 10^{-4}$ M.). The absorption coeffs. measured at several temp. and at a no. of λλ in the ultra-violet continuous band were measured and tabulated, and partial absorption coeffs. are derived. The effective amplitude of vibration of the electron producing the band was determined from the absorption coeff. curves. N. M. B.

Absorption spectra of co-ordination compounds. II. R. TSUCHIDA (Bull. Chem. Soc. Japan, 1938, **13**, 436—450; cf. A., 1938, I, 385).—The origin of the third absorption band, which occurs with negative co-ordinated groups in the *trans* positions, is discussed theoretically. Its frequency, ν_3, is given by $h\nu_3 = S + P + E - J$, where E = electron affinity of the anion, J = ionisation energy of the central ion, S = co-ordination energy, and P = work of approach of the anion. The ultra-violet absorption bands of the solid alkali halides are explained in the same way. The order of decreasing stability of various co-ordinated groups, deduced from the frequency of the second band (ν_2) in a series of related complexes, is NH_3, NO_2^-, ONO^-, H_2O, NCS^-, OH^-, NO_3^-, Cl^-, $CO_3^=$, Br^-. The photochemical stability is given by $P - R$, where R is the energy of activation, whereas the stability of the complex in thermal reactions is governed by S ($= h\nu_2$). The substitution of co-ordinated groups takes place in the direction in which S increases, *i.e.*, in such a way that the second band is displaced to shorter λλ.

H. J. E.

Relation between the configuration of metallic complex salts and their absorption spectra. II. *cis*-Trinitro-triammine cobalt. H. SUEDA (Bull. Chem. Soc. Japan, 1938, **13**, 450—452; cf. A., 1937, I, 392).—*cis*-$[Co(NH_3)_3(NO_2)_3]$ (I) in aq. solution gives an absorption curve similar to those of $[Co(NH_3)_5(NO_2)]Cl_2$ (II) and *cis*-$[Co(NH_3)_4(NO_2)_2]Cl$ (III). The extinction coeff. for the max. at λ 3250 A. was 3·6 times that for (II) and 1·6 times that for (III). (I) did not show a third absorption band. The results confirm the author's theory that the absorption bands are due to pairs of co-ordinated groups situated in the *trans* position and functioning additively.

H. J. E.

Light absorption of some compounds related to the arsenites, and some organic arsenic compounds, in the ultra-violet. IV. Arsenic compounds of importance in pharmacy. K. BRAND and E. ROSENKRANZ (Pharm. Zentr., 1938, **79**, 489—493).—The absorption spectra of KH_2PO_3, KH_2PO_4, KH_2AsO_4, Me_2AsO_2Na, $MeAsO_3Na_2$, $CH_2Bu{\cdot}CCl{:}CH{\cdot}AsO_2K$, arsanilic acid (I), atoxyl (II), arsacetin (III), spirocide, neosalvarsan, the Na compound and dihydrochloride of salvarsan were investigated. The absorption of KH_2PO_3 is markedly different from that of KNO_2, whilst the curves for KH_2PO_4 and KH_2AsO_4 are parallel. The curves for (I), (II), and (III) are also very similar. The absorption max. for all three is approx. 254 mμ. and (II) has the greatest extinction coeff. A. J. M.

Light absorption of flavones and flavanol pigments and of their glucosides. L. MARCHLEWSKI and B. SKARZYŃSKI (Biochem. Z., 1938, **297**, 56—59; cf. A., 1937, I, 280).—In order to determine the effect of the carbohydrate residues on the absorption, curves have been plotted for apiin, apigenin, and quercitrin. The residues alter the position of some of the max. and min. W. McC.

Absorption spectra of pyrrole dyes. II. A. STERN and F. PRUCKNER (Z. physikal. Chem., 1938, **182**, 117—126; cf. A., 1937, I, 548).—The absorption spectra in EtOH or dioxan solution of stercobilin (I) and of urobilin IXα, and of their respective hydrochlorides, are similar but quite distinct, showing that the substances are not identical. The solvent has little effect on the absorption. The spectrum of (I) and of its hydrochloride are of the same type as those of pyrromethene (II) and its hydrochloride, showing the presence of a (II) structure in (I). The absorption spectrum of the (I)-$CHCl_3$ compound is of the bilirubinoid hydrochloride type, showing that attachment of $CHCl_3$ to the N of the (II) chromophore has the same influence on light absorption as has salt formation. Two isomeric glaucobilins, coproglaucobilin IV γ-Me_2 ester and coproglaucobilin I α-Me_2 ester, have different absorption spectra, which are both of the same type as that of glaucobilin IXα and substances with the bilitriene system. H. J. E.

Band spectra of the tellurium halides and the isotope effect in the electronic spectra of polyatomic molecules. M. WEHRLI (Helv. Phys. Acta, 1936, **9**, 208—233; Chem. Zentr., 1936, ii, 256).—The absorption spectra of $TeCl_2$ and $TeBr_2$ between 6500 and 4700 A. are diffuse, due to predissociation. The Cl isotope effect is detectable in $TeCl_2$. For symmetrical triat. mols. linearity may be detected by comparison of the observed and calc. isotope effects. $TeCl_2$ is linear in both the ground state and the excited state. H. J. E.

Electron band spectra of the linear molecules $HgCl_2$, $HgBr_2$, HgI_2, and $TeCl_2$. M. WEHRLI (Helv. Phys. Acta, 1938, **11**, 339—356; cf. A., 1938, I, 10).—The absorption spectra of $HgCl_2$, $HgBr_2$, and HgI_2 vapours have been determined and analysed. The results agree with the known Raman frequencies of these vapours. It is shown that for absorption the mols. are linearly symmetrical, but depart from this in consequence of predissociation. The band system of $TeCl_2$ belongs to a forbidden electron transition and the intensity distribution is quite different from that of the spectra of the Hg halides. The theoretical selection rules are discussed. A. J. M.

Vibrational frequencies of the MnO_4 ion. O. SPECCHIA and G. SCANDURRA (Nuovo Cim., 1935,

12, 601—605; Chem. Zentr., 1936, ii, 260).—The band spacings, $\Delta\nu$, in the absorption spectrum of $KMnO_4$ coincide with characteristic infra-red frequencies of the MnO_4' ion. In $KMnO_4$ crystals both the λ of the bands and $\Delta\nu$ are dependent on the direction of observation. H. J. E.

Bands of the OH molecule in the spectrum of the nocturnal sky. G. DÉJARDIN and R. BERNARD (Compt. rend., 1938, **206**, 1747—1749; cf. A., 1938, I, 382).—All the observed max. in the night sky spectrum at 3060—3245 and 3420—3520 A., except three (at 3206, 3228, and 3454 A.), may be interpreted as OH bands. Their occurrence is discussed. A. J. E. W.

Experimental comparison of the absorption of light by the lower atmosphere and by the total atmosphere. (MME.) A. VASSY and E. VASSY (Compt. rend., 1938, **206**, 1893—1895).—Absorption coeffs. in the visible spectrum at ground level are calc. from measurement on two spectrograms of a continuous light source (incandescence lamp) taken successively with widely differing distances between lamp and spectrograph; relative vals. for the ultra-violet region are obtained using a H_2 discharge tube (cf. A., 1934, 1054). The total atm. absorption is determined by observations with the same spectrograph on stars at different distances from the zenith (cf. A., 1935, 800). A. J. E. W.

Absorption of light by the lower atmosphere. (MME.) A. VASSY and E. VASSY (Compt. rend., 1938, **207**, 63—65).—Absorption spectra and optical densities of the atm. to a height of 1 km. have been measured on 9 evenings and may be arranged in two classes. In one the bands of H_2O vapour, of O_2 and O_4, and of O_3 (except Chappuis bands) have been found. There is also superposed on these an absorption of const. density independent of λ. In the other class bands possess greater density, H_2O vapour bands are much accentuated, and there appears to be no superposed absorption. W. R. A.

Photo-electric measurements of the seasonal variations in daylight around 0·41 μ., from 1930 to 1937. W. R. G. ATKINS (Proc. Roy. Soc., 1938, **A**, **165**, 453—465).—Measurements were made at Plymouth of the vertical illumination in connexion with the study of the seasonal changes in the plankton in the English Channel. The results are presented in tables giving the mean, greatest, and least vals. for the daily max. for each month. The high vals. of the mean monthly illumination set 1930 apart as an exceptional year. G. D. P.

Calculation of absorption coefficients of daylight in natural waters. R. T. YOUNG, jun. (J. Opt. Soc. Amer., 1938, **28**, 95—99).—A relation between the "true" and the "vertical" absorption coeffs. is derived and discussed. A. J. E. W.

Possibility of detecting molecular hydrogen and nitrogen in planetary and stellar atmospheres by their rotation-vibration spectra. G. HERZBERG (Astrophys. J., 1938, **87**, 428—437).—This detection is possible owing to the quadrupole moments of H_2 and N_2, which are discussed. A further possibility of detecting H_2 and N_2 is by the ordinary rotation-vibration of the isotopic mols. HD and $^{14}N^{15}N$. L. S. T.

Quadrupole rotation-vibration spectrum of hydrogen. H. M. JAMES and A. S. COOLIDGE (Astrophys. J., 1938, **87**, 438—459).—The theory of the quadrupole radiation of homonuclear diat. mols. is developed for transitions between $^1\Sigma$ states, and applied in a theoretical treatment of the rotation-vibration spectrum of H_2. L. S. T.

Structure of the violet bands of cyanogen in the spectra of comets. J. DUFAY (Compt. rend., 1938, **206**, 1948—1951).—The quanta of rotation in the interval separating band max. are the greater the smaller is the distance of the comet from the sun. Secondary max. near the origins of the P and R branches of the $0 \rightarrow 0$ band are discussed. W. R. A.

Spectra of absorption by reflexion of solids in the visible and ultra-violet. Value of the method. M. BILLY and A. BERTON (Compt. rend., 1938, **206**, 1958—1960; cf. A., 1938, I, 384).—The experimental arrangement, the influence of particle size, and the method of reflecting the light are discussed. The method can be applied to investigate the mol. constitution of solids which cannot be studied by transmission methods. W. R. A.

Influence of salts on the absorption spectra of aqueous cobalt chloride solutions. R. BRDIČKA (J. Chem. Physics, 1938, **6**, 404—405).—Polemical. The experimental data of Pearce and Dawson (A., 1938, I, 226) can be explained on the view suggested previously (A., 1930, 1540). W. R. A.

Alteration of the absorption spectrum of chrome alums by the presence of heavy water of crystallisation. H. BÖHM (Ann. Physik, 1938, [v], **32**, 521—536; cf. A., 1936, 135).—The substitution of H_2O by D_2O in the K Cr Se and K Cr S alums causes shifts up to 60 cm.$^{-1}$ in the position of sharp lines in the absorption spectrum and greater shifts in the diffuse lines. It is deduced that the diffuse lines are formed by the overlapping of electronic and vibrational transitions. The continuous absorption of K Cr S alum in the blue is greatly weakened by the presence of D_2O of crystallisation. O. D. S.

Transformation of a band spectrum into a continuous spectrum under the influence of pressure. J. ROUVILLOIS and H. MURAOUR (Compt. rend., 1938, **206**, 1719—1721).—OH bands observed during combustion of explosives at low pressures disappear at $p > \sim 50$ kg. per sq. cm., a continuous spectrum and lines due to metallic impurities remaining. These lines decrease in intensity on further increasing p, finally disappearing for $p > \sim 1000$ kg. per sq. cm., or, in the case of heavy metals, appearing in absorption. A. J. E. W.

Mean absorption and equivalent absorption coefficient of a band spectrum. W. M. ELSASSER (Physical Rev., 1938, [ii], **54**, 126—129).—Mathematical. An elementary theory of the absorption of a band in which the lines have the dispersion form required by the theory of collision broadening is developed. N. M. B.

Constitution of thio-acids. (MLLE.) F. BLOCH (Compt. rend., 1938, **206**, 1733—1736; cf. A., 1938, II, 171).—The OH band at ~0·98 μ. does not occur in the absorption spectrum of liquid AcSH at 15°; it is observed at low intensity in the vapour at 95°, but this is attributed to the presence of traces of AcOH. In solution in C_6H_6 and AcOH, AcSH exists as single mols., suggesting that the absence of the OH band is not due to association. It is concluded that AcSH contains only a small proportion, if any, of the form Me·CS·OH. A. J. E. W.

Presence of the (OH)$_s$ infra-red absorption band in the intramolecular hydrogen linking. R. FREYMANN (Compt. rend., 1938, **206**, 1812—1814).—The band (at ~1·0 μ.) has been observed in the absorption spectra of *o*-OH·C_6H_4·CHO and *o*-OH·C_6H_4·CO_2Me; it also occurs with enolic compounds [CH_2Ac_2 and $CH_2(COPr^a)_2$] but not with ketonic compounds ($CH_2Ac·CO_2Et$ and $COMe_2$). It is concluded that the (OH)$_s$ band may have intramol. origin and occur in cases where the (OH)$_v$ band is absent. In such cases the intensity of the band is not appreciably affected by increase in temp., and the (OH)$_v$ band does not appear, even in the vapour; when the (OH)$_s$ band is of intermol. origin, its intensity decreases and that of the (OH)$_v$ band increases on heating. A. J. E. W.

Infra-red prism spectroscopy. R. B. BARNES (J. Opt. Soc. Amer., 1938, **28**, 140—143).—The transparency of alkali halide crystals at frequencies > the characteristic frequency is increased by cooling to liquid air temp. Suggestions are made for the construction of an infra-red spectrometer with cooled prism. The infra-red transmission curve of LiF crystals has been measured. Results indicate that a LiF prism could be used only to 6 μ. O. D. S.

[Lattice] vibrations of some fluorine derivatives. M. PARODI (Compt. rend., 1938, **206**, 1717—1719).—λλ of absorption bands have been found as follows: CaF_2, 51·5, 31; SrF_2, 69, 40·6; BaF_2, 73, 43 μ. Born's theory gives a Raman frequency of 278 cm.$^{-1}$ for SrF_2 and BaF_2; the Raman frequency for CaF_2 (325 cm.$^{-1}$) is in agreement with the val. calc. from the principal infra-red frequency and c_v. A. J. E. W.

Repetition of the whole of the vibrational spectrum of organic molecules in the neighbourhood of each of the vibrational CH frequencies, fundamental or harmonic. Y. TA (Compt. rend., 1938, **206**, 1371—1373).—A no. of weak absorption bands have been observed adjacent to the $2\nu_4$, $3\nu_4$, $\nu_4 + \delta_{45}$, and $2\nu_4 + \delta_{45}$ CH frequencies in CHX_3 (X = Cl, Br, I). The frequency differences between these weak bands and the principal bands are in each case in agreement with the vibrational frequencies deduced from far infra-red and Raman spectra. Observations on $CHCl_2·CCl_3$ and $CHCl{:}CCl_2$ indicate that the phenomenon is probably of general occurrence. A. J. E. W.

Infra-red absorption spectrum of CD_4. A. H. NIELSEN and H. H. NIELSEN (Physical Rev., 1938, [ii], **54**, 118—121).—Data and curves obtained by measurements of the CD_4 spectrum in the range 3·0—10·5 μ. show regions of absorption at 3·3, 4·4, and 10·0 μ. The respective centres are 2992·8, 3103·7 (two overlapping bands), 2259·0, and 995·86 cm.$^{-1}$ Identifications and line spacings are given, and results are compared with corresponding data for CH_4. The moment of inertia of CD_4 is $1·044 \times 10^{-39}$ g.-cm.^{2} N. M. B.

Infra-red absorption by $^{13}C^{16}O_2$ at 4·375 μ. A. H. NIELSEN (Physical Rev., 1938, [ii], **53**, 983—985).—The fundamental vibration–rotation band ν_3 has been found with its centre at λ 4·375 μ. or 2284·5 cm.$^{-1}$ A formula is found for the individual lines of the band. When corr. by the appropriate mass correction, ν_3 and the anharmonic const. assume the respective vals. 2295·8 cm.$^{-1}$ and −11·4 cm.$^{-1}$, which together give the position of the centre of the band as 2284·4 cm.$^{-1}$ in exact agreement with observation. N. M. B.

Fluorescence of the chlorins. A. STERN (Z. physikal. Chem., 1938, **182**, 186—192).—The fluorescence spectrum of mesopyrrochlorin (I) is of the same type as that of pyrroporphyrin (II); both have five bands, the former being slightly displaced towards the red. From this it follows that the chlorins and the chlorophyll derivatives in general have the same inner ring system as the porphyrins. This also follows from the general regularity between absorption and fluorescence, for the absorption spectra of (I) and (II) are also relatively similar. T. H. G.

Anisotropic organic dye molecules. Secondary valency binding as energy carrier. G. SCHEIBE and L. KANDLER (Naturwiss., 1938, **26**, 412—413; cf. A., 1938, I, 90, 117; Jelley, A., 1937, I, 291).—On optical evidence it is inferred that dyes of the *ψ-iso*cyanine class can exist as (i) normal plane mols., (ii) discrete thread-like polymerides of the ions of (i) with a layer structure, and (iii) micelle aggregates of (ii) obtained by drying streaming solutions. (i) ⇌ (ii) → (iii). These units are characterised by absorption and fluorescence spectra differing in λ and polarisation. Fresh solutions of (ii) are optically isotropic (ascribed to randomly curved mols. and intra-mol. energy transference between absorption and emission); anisotropy occurs on streaming (inter-plate or capillary) or by adsorption on gypsum or Cellophane, through straightening of (ii). The results are interpreted in terms of the different *p*-electron function in (i) and (ii), supported by confirmatory evidence and previous work. I. McA.

Luminescence of solids at low temperatures. J. T. RANDALL (Nature, 1938, **142**, 113—114).—The following substances are fluorescent at low temp.: anhyd. $BeSO_4$, anhyd. $MgCl_2$, ZnO,* $ZnCl_2$,* anhyd. $ZnSO_4$, Zn_2SiO_4, ZnS, $CdCl_2$,* $CdBr_2$, CdI_2, $HgCl_2$, Hg_2Cl_2,* Cu_2Cl_2, AgCl, AgBr, In acetylacetone,* Sm_2O_3, $Sm_2(SO_4)_3$, silicic acid, $SnCl_2$, $Pb(NO_3)_2$, $PbCl_2$, P,* $SbCl_3$, $BiCl_3$, anhyd. $MnCl_2$, anhyd. $MnBr_2$, red* and yellow forms of $PtCl_2(dipy)_2$, Na fluorescein, and rhodamine-G.B. 500. Compounds marked * fluoresce appreciably at room temp. Cu_2Cl_2 gives two different spectra according to the temp. The fluorescence of some of these compounds is considered to be that of the pure substance, but should it prove to be that of impurity phosphors then examination at low temp.

provides a more sensitive test of purity than do the usual methods. The low-temp. spectra recorded for several substances (ZnS, CdI_2, AgCl, etc.) activated by Mn show a common band lying between 5900 and 6000 A. L. S. T.

Organic phosphors with inorganic ground-materials. III. Luminescent alkaline-earth carbonates. H. CHOMSE and W. LUTZENBERGER (Z. anorg. Chem., 1938, **238**, 236—240; cf. A., 1937, I, 473).—$CaCO_3$ and $SrCO_3$, but not $BaCO_3$, when pptd. in presence of various org. substances and subsequently heated, become luminescent. The effect is a max. with specimens heated to between 370° and 430°. The luminescence resembles that of some $CaCO_3$ minerals, and $CaCO_3$ of animal origin behaves similarly. F. J. G.

Photoluminescent properties of synthetic flavin. C. DHÉRÉ and V. CASTELLI (Compt. rend., 1938, **206**, 2003—2005).—Fluorescence spectra of flavin in the cryst. state and in solution at room temp. and at —180° are discussed. Crystals and solutions give a red phosphorescence; for crystals and solutions in lactic acid and in *cyclo*hexanol this is followed by a green phosphorescence. W. R. A.

Universal constant for band spectra. Assignment of lines in a band to causes other than molecular rotation. H. DESLANDRES (Compt. rend., 1938, **206**, 1844—1848).—The relation between rotational and vibrational spectra is further discussed (cf. A., 1938, I, 115, 341). The reflexion spectrum of NaCl and the Raman spectra of NaCl and $NaClO_3$ are discussed in relation to the author's theory. A. J. E. W.

Universal constant for band spectra. Assignment of the lines of a band to causes other than molecular rotation. H. DESLANDRES (Compt. rend., 1938, **207**, 7—11).—The spectra of $ZnEt_2$ and of CHMe:CH·CO·NMe_2 are discussed (see preceding abstract). W. R. A.

Molecule of sulphur and its Raman spectrum. S. BHAGAVANTAM (Physical Rev., 1938, [ii], **53**, 1015).—Methods based on group theory are applied to the investigation of the normal modes of oscillation of the S_8 mol. Tabulated results indicate two strong and well polarised lines and five depolarised lines in the Raman spectrum. Predictions are in good general agreement with the observations of Venkateswaran (cf. A., 1937, I, 9). N. M. B.

Identification of a mercuric chlorobromide by Raman effect. (MLLE.) M. L. DELWAULLE (Compt. rend., 1938, **206**, 1965—1967).—The Raman spectra of EtOH solutions of $HgBr_2$, of $HgCl_2$, and of a mixture of $HgBr_2$ and $HgCl_2$ are recorded and support the reaction $HgBr_2 + HgCl_2 \rightarrow 2HgBrCl$ (I). (I) is characterised by the displacements 139, 232, and 347 cm.$^{-1}$ Spectra of crystals prepared from a mixture of $HgCl_2$ and $HgBr_2$ in EtOH and from a fused equimol. mixture of the two simple halides are very similar to that for the solution of (I). W. R. A.

Raman spectrum of perchloric acid and its anhydride. R. FONTEYNE (Natuurwetensch. Tijds., 1938, **20**, 112—119).—The Raman spectra of $HClO_4$ show that mols. of the pseudo-acid OH·ClO_3, symmetry C_{3v}, occur in acid of >73% concn. Lines due to vibrations of the ClO_3 group occur in the spectrum of Cl_2O_7, which probably has an angular structure and a dipole moment. S. C.

Raman effect in liquid ethylene and ethane. G. GLOCKLER and M. M. RENFREW (J. Chem. Physics, 1938, **6**, 409—410).—Two lines reported in the Raman spectrum of liquid C_2H_4 (A., 1938, I, 228) are absent in the spectrum of gaseous C_2H_4 but present in the infra-red spectrum of the gas. Similarly for C_2H_6, two lines in the Raman spectrum of the liquid apparently coincide with lines in the infra-red absorption of gaseous C_2H_6. Such a coincidence is prohibited in symmetrical mols. by selection rules. Reasons are adduced to show that this apparent coincidence is not due to isotopic shifts arising from ^{13}C but, more probably, arises because the selection rules for the gas break down when they are applied to the liquid state. W. R. A.

Carbon isotope effect in the Raman spectrum of dimethylacetylene. G. GLOCKLER and M. M. RENFREW (J. Chem. Physics, 1938, **6**, 408—409).—The previous explanation of 4 weak lines accompanying the 2 strong Raman lines of CMe:CMe at 2235 and 2313 cm.$^{-1}$ (A., 1935, 146) is discarded. One pair is due to an isotopic shift caused by mols. containing ^{13}C and the other to lines excited by weak members of the 4358 A. Hg triplet. W. R. A.

Raman spectrum of benzene under high dispersion and the isotope effect. B. S. R. RAO (J. Chem. Physics, 1938, **6**, 343—344).—Examination of the Raman spectrum of C_6H_6 at a dispersion of 10 A. per mm. has confirmed the view that the 984 cm.$^{-1}$ displacement is due to $^{13}C^{12}C_5H_6$. The ratio of the intensity of this line to that of the 992 cm.$^{-1}$ line is 6 : 100 as reported by Cheng *et al.* (A., 1938, I, 175). The lines at 3048 and 3060 cm.$^{-1}$ are also discussed. W. R. A.

Raman spectrum of indanone. (MLLE.) D. BIQUARD (Compt. rend., 1938, **206**, 1824—1826).—Cryst. indanone gives two Raman νν, 1703 and 1715 cm.$^{-1}$ at 23°. The liquid and solutions in Et_2O and CCl_4 give a single frequency of 1707—1716 cm.$^{-1}$ These νν are attributed to the C:O linking. A. J. E. W.

Raman spectra of compounds containing the N–S link. W. R. ANGUS, A. H. LECKIE, and T. I. WILLIAMS (Trans. Faraday Soc., 1938, **34**, 793—797; cf. A., 1936, 136).—Raman spectra of $PhSO_2·NH_2$, $C_6H_4Me·SO_2·NH_2$, piperidine 1 : 1′-disulphide, $NH_2·SO_3H$, and $N(SO_3K)_3$ all show a displacement of about 1070 cm.$^{-1}$ which is assigned to the N–S link. F. L. U.

Effect of temperature on the degree of depolarisation of gaseous carbon dioxide, nitrous oxide, and acetylene. R. SCHMIDT (Physikal. Z., 1938, **39**, 574—580).—The degree of depolarisation of CO_2, N_2O, and C_2H_2 was determined at 20°, 40°, 60°, and 85°. There was no variation of the val. with temp. to within ±5%. A. J. M.

Electrical charge of barium sulphate crystals. R. RUYSSEN (Natuurwetensch. Tijds., 1938, **20**, 103—104).—$BaSO_4$ prepared from $BaCl_2$ and Na_2SO_4 or

K_2SO_4 is always negatively and that from H_2SO_4 always positively charged. S. C.

Photo-electric sensitivity of zinc oxide. E. HOJA (Z. physikal. Chem., 1938, **40**, **B**, 263—272).—The light-sensitivity of ZnO has been studied in relation to Baur's theory (A., 1932, 581) of the analogy between photolysis and electrolysis. It has been shown that pure aq. suspensions of ZnO from which the adsorbed H_2O has been driven show no Becquerel effect, the necessary and sufficient condition for the production of which is the presence of a trace of hydrated ZnO. Baur's theory can be reconciled with these observations if the hydrated ZnO behaves as a cathode depolariser. T. H. G.

Atomic irregularities with simple compounds. J. H. DE BOER (Chem. Weekblad, 1938, **35**, 542—552).—A review of published work on and the theory of the conduction of electricity by crystals of electrolytes due to irregularities in the crystal structure. D. R. D.

New Rochelle-salt type of dielectric. G. BUSCH (Helv. Phys. Acta, 1938, **11**, 269—298).—KH_2PO_4 (I) and KH_2AsO_4 (II) have been shown to possess dielectric properties similar to those of Na K tartrate in the direction of the *c* axis. The upper Curie points are at 115° and 91° K., respectively. The variation of the dielectric const. in the direction of the *c* axis with temp. was determined. For (I) $\epsilon_{max.}$ is 47,500 at 114° K., and for (II) the max. is 35,600 at 92° K. In the direction of the *a* axis (*i.e.*, perpendicular to the *c* axis) the dielectric const. is independent of frequency and field strength, and varies less with temp. The polarisation reaches a saturation val. of $4{\cdot}3 \times 10^{-6}$ and $5{\cdot}0 \times 10^{-6}$ coulombs per sq. cm. for (I) and (II), respectively. $NH_4H_2PO_4$ and $NH_4H_2AsO_4$ behave in an exactly similar manner to the K salts at room temp. but undergo a transformation at 155° and 220° K., respectively, below which temp. the dielectric const. cannot be determined. A. J. M.

Viscosity dispersion of dielectric constants of organic liquids. E. PLÖTZE (Naturwiss., 1938, **26**, 460—461).—The viscosity dispersion of the dielectric const. of dil. solutions of polar substances ($PhNO_2$, $C_{10}H_7{\cdot}NO_2$, alcohols) in liquids of high viscosity (hydrocarbons with η 10—50 poises) has been determined in the λ range 350—14 m. and between 10° and 40°. The effect of temp. on the dispersion was determined for solutions of different concns. The effect of concn. can be explained by Debye's theory of rotational hindrance of polar mols. A. J. M.

Dielectric polarisation of a long-chain ketone at constant volume and variable temperature. A. MÜLLER (Proc. Roy. Soc., 1938, **A**, **166**, 316—324).—The material, $CO(C_8H_{17}\text{-}n)_2$, is contained in a coaxial cylindrical condenser designed to withstand a pressure of 2000 atm. The experiments show that the rapid rise of the polarisation previously observed at const. pressure is intimately connected with the large expansion of the crystal lattice near the m.p. G. D. P.

Behaviour of organic compounds in binary systems on the basis of their dielectric properties. K. HRYNAKOWSKI and J. JESKE (Ber., 1938, **71**, [*B*], 1415—1421).—The dielectric behaviour of fifteen binary systems within the limits of 0—100% of both components has been determined by the resonance method or by the procedure of Chrétien and Laurent. Polar and non-polar materials comprising the following have been selected: azobenzene (I)–C_6H_6; (I)–dioxan (II); (I)–*o*-$NO_2{\cdot}C_6H_4{\cdot}OH$; (I)–*s*-$C_6H_3(NO_2)_3$; (I)–$PhNO_2$; C_6H_6–synthetic camphor; PhOH–β-$C_{10}H_7{\cdot}NH_2$; PhOH–$COPh_2$; PhOH–*m*-$C_6H_4(OH)_2$; PhOH–*p*-$C_6H_4Me{\cdot}NH_2$; *p*-$OMe{\cdot}C_6H_4{\cdot}NH_2$–*m*-$C_6H_4(OH)_2$; (I)–$PhNO_2$ in (II); (I)–$C_6H_3(NO_2)_3$ in (II). A definite dependence of dielectric const. on polarisation or on the formation of mol. compounds does not exist. In certain cases characteristic changes in the course of the graph are observed which according to concn. are compatible with the formation of mol. compounds but this concordance cannot be generalised. In addition, the influence of the electric field of the condenser causes polarisation of the mols. H. W.

Measurement of dielectric loss and of high-frequency conductivity. V. Quartz condenser with low losses. P. WULFF, H. SCHWINDT, and S. TAKASHIMA. **VI.** P. WULFF and S. TAKASHIMA (Z. physikal. Chem., 1938, **B**, **39**, 315—321, 322—351; cf. A., 1938, I, 345).—V. The apparatus is described.

VI. Measurements are recorded. In the system PhOH–C_6H_6 only conductivity losses were observed. The temp. coeff. was negative. The losses were greatly increased by the addition of NH_2Ph. The conductivity arises from proton exchange due to polar association of OH groups. For *cyclo*hexanol (I) in C_6H_6, *cyclo*hexane, and dekalin, dipole and conductivity losses were observed, and were used to calculate relaxation times and apparent mol. radii. The latter shows a max. with increasing concn. The orientation polarisation of (I) in the three solvents passes through a max. with increasing concn. (I) at a concn. of about 0·5 mol. fraction is present largely in the form of polar association complexes. H. J. E.

Dielectric absorption in polar media and the local field. R. H. COLE (J. Chem. Physics, 1938, **6**, 385—391).—Dielectric dispersion and absorption in polar liquids under the influence of high-frequency fields are discussed on the basis of a modified Onsager theory for the local field. The agreement with experiment and with the hindered rotation theory of Debye is good. W. R. A.

Dielectric constant of dipole liquids. C. J. F. BÖTTCHER (Physica, 1938, **5**, 635—639).—Theoretical. Van Arkel and Snoek's formula for ϵ in polar liquids (A., 1932, 983; 1934, 357) is derived, using Onsager's reaction field theory. A. J. E. W.

Dielectric investigations with carboxyhæmoglobin. S. ARRHENIUS (Physikal. Z., 1938, **39**, 559—564).—The relaxation time and dipole moment of carboxyhæmoglobin have been determined in connexion with the investigation of the electrical properties of high-mol. substances. Calculation shows that the envelope of H_2O around the protein mol. plays a great part in deciding the val. of the dipole moment. A. J. M.

Electric moments of methyl and ethyl alcohol. J. D. STRANATHAN (J. Chem. Physics, 1938, **6**, 395—398).—The dielectric const. of MeOH vapour has been determined by the heterodyne beat method at 14 temp. between 25° and 206°; at each temp. measurements were made at an average of 23 pressures, ranging from approx. zero to almost saturation. The measured moment of MeOH is 1·706±0·005 D. By taking the sum of the electronic and at. polarisations as 8·6 a moment of 1·688±0·006 D. is obtained. The mean, 1·698±0·005 D., is given as the most probable val. The data of Knowles (A., 1933, 9) on EtOH vapour have been recalc. by the method used for MeOH. The most probable moment of EtOH is 1·702±0·007 D. W. R. A.

Determination of the dielectric constant and the dipole moment of thionyl bromide and thionyl chloride. M. BEYAERT and F. GOVAERT (Natuurwetensch. Tijds., 1938, **20**, 119—124).—$SOCl_2$ and $SOBr_2$ have $\epsilon_{20°}$ 9·25, 9·06, and μ 1·60, 1·47, respectively. S. C.

Dielectric constants of fluorine compounds. R. M. FUOSS (J. Amer. Chem. Soc., 1938, **60**, 1633—1637).—Dipole moments, derived from Schering bridge measurements with the gases, are: CF_4 0·0, CF_3Cl 0·47, CF_2Cl_2 0·55, $CFCl_3$ 0·53, CHF_2Cl 1·41, $CHFCl_2$ 1·34, CHF_2Br 1·30, CF_2Br_2 0·72, $CF_3{\cdot}CF_3$ 0·0, $CClF_2{\cdot}CClF_2$ 0·0, $CMeF_3$ 2·27, $CMeClF_2$ 2·13, $CF_3{\cdot}CF_2Cl$ 0·14, $CF_3{\cdot}CH_2Cl$ 1·64. The vals. are in agreement with the theory of induction. E. S. H.

Configuration of certain diphenyl compounds indicated by their dipole moments. R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 967—972).—The following dipole moments are determined: 2 : 2′-dinitro- 5·19, 4 : 4′-dichloro-2 : 2′-dinitro- 4·90, 4 : 4′-dibromo-2 : 2′-dinitro- 4·92, 2 : 2′ : 4 : 4′-tetranitro- 4·38, 4 : 4′-dichloro-2 : 2′-dimethyl- (I) 0·75, 4 : 4′-dinitro-2 : 2′-dimethyl- 1·30, and 2 : 2′-*dimethyldiphenyl* (I) 0·66; Me_2 2 : 2′-diphenate 2·42, its 4 : 4′-Br_2- (II) 2·16 or 2·17 and 4 : 4′-$(NO_2)_2$-derivative 1·99 or 2·03; diphenic anhydride (III) $5{\cdot}29 \times 10^{-18}$ e.s.u. The effects of the 4 : 4′-substituents are > those calc., but do not disprove the assumption that the C in positions 1, 1′, 4, and 4′ are collinear. The calculations are subject to various errors, particularly with respect to the assumption that the rings lie in perpendicular planes. Prep. of many of the compounds is modified. (I) has m.p. 48°; (II) has m.p. 124°. The dipole moment of (III) is almost that of *o*-$C_6H_4(CO)_2O$. R. S. C.

Dielectric polarisation. XXII. Series effect on the dipole moments of some alkyl halides in solution. E. G. COWLEY and J. R. PARTINGTON (J.C.S., 1938, 977—983).—A detailed account of work already noted (A., 1938, I, 121). W. R. A.

Structure of carbamide and its derivatives. E. BERGMANN and (MISS) A. WEIZMANN (Trans. Faraday Soc., 1938, **34**, 783—786).—Dipole moments in dioxan solution have been determined as follows: $CO(NH_2)_2$ ~8·6, $NH_2{\cdot}CO{\cdot}NHPh$ 3·6, $NH_2{\cdot}CO{\cdot}NPh_2$ 2·7, $NEt_2{\cdot}CO{\cdot}NHPh$ 3·25, $CO(NPhMe)_2$ 3·6, $CS(NH_2)_2$ ~7·6, $NH_2{\cdot}CS{\cdot}NHMe$ 4·2, $CS(NHPh)_2$ 4·9 D. The results support the view that $CO(NH_2)_2$ and $CS(NH_2)_2$ exist to a large extent as zwitterions, and that this tendency is diminished by substitution. F. L. U.

Dipole moments and molecular structure. Dipole moment of nitron. F. L. WARREN (J.C.S., 1938, 1100).—The dipole moment of nitron is 7·2 D., which indicates that it has a zwitterion structure, probably representable as a resonance hybrid of three structures. W. R. A.

Theory of the scattering of light. HANS MUELLER (Proc. Roy. Soc., 1938, **A**, **166**, 425—449).—The Krishnan effect, concerning the state of polarisation of light scattered by liquid and solid media in a direction normal to the incident beam, is considered theoretically. Application of Brillouin's method shows that every substance exhibiting a Krishnan effect should also show a Mie effect. Both effects are related to the photo-elastic properties in the case of solids, and to the consts. of streaming birefringence in the case of liquids. A new theory of scattering of light in glasses, depending on the presence of "frozen-in" strains, is formulated and leads to results consistent with observations. Attention is directed to the possibility of using the scattering data to determine the size of mol. clusters and of colloidal particles. G. D. P.

Ultra-violet dispersion of heavy water. M. BAYEN (Compt. rend., 1938, **206**, 1715—1717; cf. A., 1934, 348).—For D_2O at 18·9°, $n^2 = 1{\cdot}74529 + 2{\cdot}63677 \times 10^{-3}/(\lambda^2 - 0{\cdot}02300) + 3{\cdot}9384 \times 10^{-3}/(\lambda^2 - 0{\cdot}0014375)$, λ being expressed in μ. (λ < 2230 A.). A. J. E. W.

Absolute determination of Kerr constants with alternating potential. Y. BJÖRNSTAHL (Physikal. Z., 1938, **39**, 585—587).—The connexion between the double refraction produced in a liquid by an alternating field and the Kerr const. is discussed. It is shown that it is possible to carry out an abs. determination of the Kerr const. with a.c., assuming the accuracy of the Talbot law. The theory was confirmed with CS_2 and PhCl by comparing the phase displacement in an alternating and a direct field. A. J. M.

Valency of praseodymium and of terbium. W. PRANDTL and G. RIEDER (Z. anorg. Chem., 1938, **238**, 225—235).—When mixtures of Pr_2O_3 and Y_2O_3 are heated in O_2 under pressure they take up excess O in ratios $O : Pr_2O_3 > 1$ and approaching 2, as required for Pr^V. In Y_2O_3–Tb_2O_3 mixtures the max. ratio $O : Tb_2O_3$ is 1, indicating Tb^{IV}. F. J. G.

Valency forces and theoretical chemistry. K. L. WOLF and H. G. TRIESCHMANN (Z. ges. Naturwiss., 1936, **2**, 1—14; Chem. Zentr., 1936, ii, 6).—A uniform theory of valency forces regarded as electrical interactions between ions, dipoles, or quadrupoles is developed from Wolf's work (summarised) on intermol. forces and residual valency phenomena. J. S. A.

Box models in the theory of organic compounds. O. SCHMIDT (Naturwiss., 1938, **26**, 444—445).—Many physical properties of C_6H_6 and its derivatives can be explained by considering the 6 "extra" electrons as contained within a potential "box" in the form of a cylinder with its axis per-

pendicular to the plane of the mol. The principle is also applicable to other classes of org. compounds. W. O. K.

Generalisation of the theory of ferromagnetism. F. BITTER (Physical Rev., 1938, [ii], **54**, 79—86).—Mathematical. An extension of the Weiss-Heisenberg theory. The proposed equations of state attempt to describe antiferromagnetism (the case in which oppositely directed spins on adjacent atoms have the lowest energy), pure metals having <1 spin per atom, and the magnetic properties of alloys. N. M. B.

Density of energy states in solids. S. H. BAUER (J. Chem. Physics, 1938, **6**, 403—404).—Mathematical. By using thermodynamic functions of the aggregate the energy levels of crystals and very complicated mols. can be located W. R. A.

Mechanism of the primary photodissociation process of organic molecules. R. G. W. NORRISH (Nature, 1938, **141**, 1138).—A criticism (cf. A., 1938, I, 341). L. S. T.

Relaxation time and molecular configuration. S. MIYAMOTO and A. BUDÓ (Physikal. Z., 1938, **39**, 587—588).—It is possible to discover the configuration of mols. from their relaxation times since according to Debye the relaxation time of a spherical polar mol. of radius a is $\propto a^3$. The relaxation times of 2 : 3- (I) and 1 : 8-dichloroanthraquinone (II) (these mols. being sufficiently large to have a definite configuration and possessing no groups capable of rotation) and of o-$C_6H_4Cl_2$ were determined. That of (I) is 1·7 times that of (II) and 8·4 times that of o-$C_6H_4Cl_2$. These results agree with the assumption that the mols. are ellipsoidal rather than spherical. A. J. M.

Electronic structure of the first-row hydrides. G. W. KING (J. Chem. Physics, 1938, **6**, 378—384).—Analysis of the potential curves of BeH, BH, CH, NH, OH, and FH with the aid of Stehn's energy expressions (A., 1937, I, 223) show that the force consts. (k) and internuclear distances (r_e) are determined by the $2s^2$—$1s$ exchange, are not influenced by p electrons, and vary regularly with the at. no. (Z). Dissociation energies are largely influenced by p electrons and therefore are not smooth functions of Z, k, or r_e. W. R. A.

Hindered internal rotation of ethane. G. B. KISTIAKOWSKY, J. R. LACHER, and F. STITT (J. Chem. Physics, 1938, **6**, 407).—The heat capacities of C_2H_6 and C_2D_6, determined by the "hot wire" method at 94° and 100° K., are independent of the nature of the wire, the gas pressure, and the temp. difference between the wire and the surrounding wall. The contributions of hindered internal rotation are evaluated at both temp. The existence of a high potential barrier hindering internal rotation and ~3000 g.-cal. per mol. explains the experimental data. W. R. A.

Absence of spin effects in the heat capacity of ethane gas. E. B. WILSON, jun. (J. Chem. Physics, 1938, **6**, 408).—A detailed calculation of the partition function and heat capacity of each of the spin species of C_2H_6 has disproved the suggested explanation of Hunsman (A., 1938, I, 295) that the neglect of spin and symmetry effects in the calculation gave rise to the low val. of the heat capacity of the gas at 100° K. The existence of a high potential barrier is the only alternative explanation (cf. preceding abstract). W. R. A.

Surface tension of liquid crystals. A. FERGUSON and S. J. KENNEDY (Phil. Mag., 1938, [vii], **26**, 41—49).—The surface tensions of anisaldazine, p-azoxyanisole, and p-azoxyphenetole (two samples) have been measured over a wide range of temp. (including the transition temp.) by a method which requires only a few cu. mm. of liquid. W. R. A.

Surface tension of fused Al_2O_3 and La_2O_3. H. VON WARTENBERG, G. WEHNER, and E. SARAN (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 65—71; Chem. Zentr., 1936, ii, 444).—Measurements by the falling drop method give γ (in dynes per cm.) 577±30 at 2050° for Al_2O_3 and 560±30 for La_2O_3 at 2320°. H. J. E.

Parachor and thermal conductivity of metallic elements. B. N. SEN (Gazzetta, 1938, **68**, 307—311).—The expression $Q = KDd/PZ \times A\nu/N$ gives vals. of the thermal conductivity, Q, of metals in good agreement with the experimental vals. (K = const. dependent on the nature of the lattice and on the no. of free electrons in the atom, D = distance of closest packing, d = at. diameter, P = parachor, Z = at. no., A = at. wt., ν = at. frequency, and N = Avogadro's no.). O. J. W.

Relationships between the parachor values and the physical constants of homologous series. D. T. LEWIS (J.C.S., 1938, 1056—1061).—The equations relating the parachor vals. with the crit. temp. and b.p. (A., 1938, I, 179) hold only for chemically similar mols. containing the same no. of atoms. A new relation is established which holds for homologous series of all except associated substances. The silicoparaffins obey this relation and have the same numerical consts. as the corresponding hydrocarbons. Ring-closure does not affect the generality of this relation. Utilising these generalisations, physical consts. can be predicted and doubtful at. parachors calc. The connexion between these relations and the co-vol. factor of the van der Waals equation is discussed. W. R. A.

Constants of the Eötvös rule in the series of homologous fatty acid esters. O. ALBERT (Österr. Chem.-Ztg., 1938, **41**, 287—288).—The surface tensions of oleic, nonoic, nonenoic, and cinnamic acids and their simple esters have been determined at 20°, 25°, 100°, and 180°; the Eötvös consts. have been calc. In each series of esters the Eötvös const. rises with increasing mol. wt. E. S. H.

Atom factor for X-rays. T. DERENZINI (Nuovo Cim., 1936, [ii], **13**, 79—90; Chem. Zentr., 1936, ii, 19).—Methods of calculating at. structure factors are reviewed. J. S. A.

Radial lines in Laue spot photograms. C. S. BARRETT (Physical Rev., 1938, [ii], **53**, 1021).—Explanations of the effects reported by Wadlund (cf. A., 1938, I, 389) are discussed. A cross-grating

effect is not conclusive and does not exclude an interpretation on the basis of strain. N. M. B.

X-Ray study of lattice distortion in rhodium. G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1938, **50**, 501—518).—Measurements of the intensities of *X*-ray reflexions from filed and chemically prepared Rh powder are obtained in abs. units by conversion, from relative data, by comparison with Al reflexions. Experimental scattering factors for both types for higher-order reflexions agree with theory, but for lower-order reflexions are markedly low, suggesting the existence of appreciable primary extinction. The variation of the factor ratio for the two types with $(\sin\theta)/\lambda$ can be accounted for almost entirely in terms of primary extinction, and there is little residual effect due to lattice distortion as in Cu and Ni. Measurements of the widths of the reflexions are discussed in relation to various theories of lattice distortion produced by cold-work, and to the difficulties examined by Boas (cf. A., 1938, I, 124). Results are incompatible with the view that the broadening is due to smallness of crystal size, and may be explained in terms of a variation of the lattice spacing about the normal mean val. due to stresses caused by filing. The distribution of the variation is calc., and the internal energy of the worked metal is derived. N. M. B.

X-Ray investigation of $NaSb(OH)_6$, $NaSbF_6$, $NaSbO_3$, and similar substances. N. SCHREWELIUS (Z. anorg. Chem., 1938, **238**, 241—254).—$AgSb(OH)_6$ is isomorphous with $NaSb(OH)_6$ (I), *i.e.*, tetragonal-bipyramidal; *a* 8·12, *c* 7·91 A., space-group C_{4h}^4; the unit cell contains 4 mols. The lattice consts. found for (I) agree with those of Beintema (A., 1936, 143), and the detailed structure assigned differs only slightly with regard to the OH positions. $NaSbF_6$ is cubic, *a* 8·18 A., space-group T_h^6; the unit cell contains 4 mols. The structure differs only slightly from that of (I) and in both of these compounds the anions and cations are arranged as in a NaCl lattice. $NaSbF_4(OH)_2$ is trigonal, *a* 5·277, *c* 9·98 A., space-group D_{3d}^2; the unit cell contains 2 mols. $LiSb(OH)_6$ is hexagonal or trigonal; the results are in agreement with a unit cell having *a* 5·351, *c* 4·918 A., but the true unit cell is probably larger. $NaSbO_3$ (II) exists in two forms, the one isomorphous with ilmenite and having *a* 6·14 A., α 51·3°, the other cubic with *a* 10·20 A., space-group O_h^7; at. positions are given. The structure is derived from that of pyrochlore. $AgSbO_3$ is isomorphous with the cubic form of (II) and has *a* 10·23 A. $LiSbO_3$ has a complicated structure. F. J. G.

Ice. (SIR) W. BRAGG (Proc. Roy. Inst., 1938, **30**, 283—301).—A lecture.

Metastability of elements and compounds as a consequence of enantiotropy or monotropy. XIX. Monotropy of ice under 1 atmosphere pressure (ice VIII). E. COHEN and C. J. G. VAN DER HORST (Z. physikal. Chem., 1938, **40**, **B**, 231—251).—Dilatometric and optical experiments indicate that when supercooled H_2O, which is mixed with C_6H_6, PhMe, xylene, or decalin, is allowed to freeze a new cubic modification of ice (ice VIII) is formed together with ordinary hexagonal ice I. This is confirmed by *X*-ray photographs which show that the edge of the unit cube is 9·68 A.; $d_4^{-30} = 1{\cdot}05$ and so there are 32 mols. per unit cell. Other methods of prep. of the new modification are given; it is also formed naturally under certain conditions. Ice VIII is converted monotropically into ice I. T. H. G.

Growth kinetics of regular association of $KClO_3$ and $KMnO_4$. II. H. SEIFERT (Z. Krist., 1938, **99**, 16—26; cf. *ibid.*, 1937, **96**, 111).—A dynamic lattice-geometric interpretation based on the known component structures is sought for the intergrowth, held to be anomalous. In reply to criticism (Buckley, A., 1938, I, 125) the rule $(001)_1 \| (001)_2$ is withdrawn. The first part of Buckley's rule ($[010]_1 \| [010]_2$) is explained one-dimensionally by inductive superposition of lattice lines of ions suitably spaced and charged; deviations from the second part are indicated and discussed. I. MCA.

Crystal structure of cæsium chromate, Cs_2CrO_4. J. J. MILLER (Z. Krist., 1938, **99**, 32—37; cf. A., 1937, I, 17).—From Laue and oscillation *X*-radiograms, the rhombic cell containing 4 mols. has *a* 6·226, *b* 11·135, *c* 8·363 A.; ρ 4·345; space-group V_h^{16}—*Pmcn*. Complete at. parameters determined in accord with estimated intensities give a structure similar to that of its isomorphs Cs_2SO_4 and K_2CrO_4. I. MCA.

[Crystal] structure of cryolite, Na_3AlF_6. S. VON NÁRAY-SZABÓ and K. SASVÁRI (Z. Krist., 1938, **99**, 27—31).—A complete analysis in accord with intensities from oscillation *X*-radiograms corrects Menzer's structure. The monoclinic cell contains 2 mols. with *a* 5·46, *b* 5·61, *c* 7·80 A., β ~90°; ρ 2·900; space-group C_{2h}^5—$P2_1/n$. Na ions and deformed octahedra of AlF_6 (central Al, corner F) with Al—F 1·79—1·83 and F—F 2·51—2·62 A. form the structure. 3 Na· are each surrounded by 6 F, 2 irregularly, the other almost regular-octahedrally with Na—F 2·23—2·32 A. I. MCA.

[Crystal] structure of silver permanganate, $AgMnO_4$. K. SASVÁRI (Z. Krist., 1938, **99**, 9—15).—From oscillation *X*-radiograms (Mo $K\alpha$) the monoclinic cell contains 4 mols. with *a* 5·665, *b* 8·27, *c* 7·127 A., β 92° 30′; ρ 4·49; space-group C_{2h}^5—$P2_1/n$. Complete at. parameters are deduced in accord with estimated intensities. The structure is a slight modification of the rhombic $BaSO_4$ type. I. MCA.

Crystal structure of sodium metaborate, $Na_3(B_3O_6)$. S. FANG (Z. Krist., 1938, **99**, 1—8).—Cell data and space-group (A., 1937, I, 401) are confirmed. A layer structure similar (exceptionally) to that of the K salt (A., 1938, I, 68) is completely determined from *X*-ray oscillation photograms, using Patterson and ordinary Fourier methods. The plane $(B_3O_6)'''$ radical, possibly a resonance triad, consists of 3 almost equilateral BO_3 triangles (central B) each sharing 2 corner O_{II} to form a ring. B—O_I, B—O_{II}, O_I—O_{II}, O_{II}—O_{II} are 1·38, 1·34, 2·37, and 2·32 A., respectively. Each Na is surrounded by 7 O (5 O_I, 2 O_{II}) distant ~2·53 A. I. MCA.

Structure of durangite, $NaAlF(AsO_4)$. P. KOKKOROS (Z. Krist., 1938, **99**, 38—49; cf. A., 1937, I, 604).—The space-group is C_{2h}^6. From analysis of *X*-ray rotation and Weissenberg photograms using Fourier series and other methods, complete at. parameters and interdistances are deduced. These, and revised cell elements (*c* 7·30 A., β 119° 22′ express the pseudo-hexagonal nature and elicit structural relations), are almost identical with those for the isomorphous titanite, $CaTiO(SiO_4)$, confirming the mineral classification of Strunz (A., 1938, I, 235). I. McA.

Determination of the characteristic temperature of MgO from *X*-ray measurements. H. S. RIBNER and E. O. WOLLAN (Physical Rev., 1938, [ii], **53**, 972—976).—The characteristic temp. measured directly by the *X*-ray method gave the val. 743° K. for the range room temp.—liquid air temp. The val. calc. with the aid of theoretical at. scattering factors is in qual. agreement. The characteristic temp. found from sp. heat data shows marked dependence on temp. but the mean val. for the range agrees with that found by *X*-rays. N. M. B.

Structure of $MgSO_4,6H_2O$ (α). K. H. IDE (Naturwiss., 1938, **26**, 411).—The *X*-ray structure of monoclinic-prismatic crystals of $MgSO_4,6H_2O$ (α) has been determined. It has *a* 10·0$_4$, *b* 7·1$_5$, *c* 24·3$_4$ A., β 98° 34′; 8 mols. of $MgSO_4,6H_2O$ in elementary parallelepiped; space-group C_{2h}^6—*C*2/*c*. A. J. M.

Space-group of kieserite, $MgSO_4,H_2O$. G. WEINERT (Naturwiss., 1938, **26**, 410).—The lattice consts. of kieserite from the "Niedersachsen" pit at Wathlingen are a_0 6·89, b_0 7·69, c_0 13·51 A., β 91° 7′ 30″; 8 mols. in unit cell; space-group C_{2h}^6. A. J. M.

Crystal structure of chiolite. C. BROSSET (Z. anorg. Chem., **238**, 201—208).—Chiolite, $Na_5Al_3F_{14}$, is tetragonal, *a* 7·00, *c* 10·39 A., space-group D_{4h}^9; the unit cell contains 2 mols. The structure is built up of layers of AlF_6''' octahedra. F. J. G.

Crystal structure of ammonium cupridiammoniotetrachloride. A. SILBERSTEIN (Compt. rend., 1938, **206**, 1737—1739).—The unit cell of $(NH_4)_2[CuCl_4,2NH_3]$ has *a* and *b* 7·74, *c* 8·84 A.; ρ 1·92. The structure is based on the NH_4Cl lattice, one third of the Cu atoms being regularly arranged in the admissible positions, and the remaining two thirds irregularly distributed. A. J. E. W.

Crystal structure of lithium ferrite. A. HOFFMANN (Naturwiss., 1938, **26**, 431).—Li_2O,Fe_2O_3 crystallises with the rock-salt structure. The unit cell contains 1 mol. of $Li_2Fe_2O_4$. $Li_2O,5Fe_2O_3$ may be formed by the reaction $Li_2Fe_2O_4 + 4Fe_2O_3 = Li_2O,5Fe_2O_3$. The latter crystallises with a lattice similar to that of the spinels, and is strongly magnetic. The lattice const. is 8·309 A., the unit cell containing 2 mols. of $Li_2Fe_{10}O_{16}$. A. J. M.

Crystal structure of black basic mercuric chloride, $2HgO,HgCl_2$. S. GAWRYCH (Rocz. Chem., 1938, **18**, 107—111).—The elementary cell has *a* 6·25, *b* 6·83, *c* 6·74 A., β 114° 03′, and contains 2 mols. of $2HgO,HgCl_2$ (I). The structure of crystals obtained by different methods is the same. Driot's $3HgO,HgCl_2$ (A., 1911, ii, 397) is shown to be a mixture of (I) and HgO. R. T.

Crystal structure of YF_3. W. NOWACKI (Naturwiss., 1938, **26**, 463).—YF_3 crystallises in the cubic system, with *a* 5·644±0·003 A. There are 3 mols. in the unit cell. ρ (*X*-ray) = 4·017; space-group T_h^6. A. J. M.

Structure of choleic acids determined by means of Patterson's analysis. G. GIACOMELLO (Atti R. Accad. Lincei, 1938, [vi], **27**, 101—108).—The results of carrying out a Patterson's analysis of the *X*-ray reflexions from the [001] plane of choleic acids are described. All the vectors joining the origin to the nearest max. are ∢3·7 A. The interpretation of this distance is discussed. O. J. W.

***X*-Ray study of thymonucleic acid.**—See A., 1938, III, 757.

Space group of carbamide-sodium chloride hydrate. I. SCHAACKE (Naturwiss., 1938, **26**, 411).—*X*-Ray investigation of the structure of the rhombic double salt $NaCl,CO(NH_2)_2,H_2O$ shows the existence of a {112} face in addition to those formerly observed, so that the crystal can now be definitely assigned to the rhombic-bipyramidal class. Laue diagrams give $T_{001} = 17·63±0·10$ A.; $T_{100} = 5·24±0·05$ A.; $T_{010} = 6·50±0·05$ A.; $a:b:c = 0·7955:1:2·6800$. The space-group is $D_{2h}^{25} = V_{2h}^{25}$. There are 4 mols. in the unit cell. A. J. M.

Structure of aromatic compounds. III. Benzophenone. K. BANNERJEE and A. HAQUE (Indian J. Physics, 1938, **12**, 87—94).—$COPh_2$ crystallises in the space-group $P2_12_12_1$, with *a* 10·17, *b* 12·06, *c* 7·98 A. Relative intensities of numerous reflexions are given. From the magnetic anisotropy it is calc. that the planes of the two Ph rings are inclined at 135°, the keto-C lying at the intersection of these planes. T. H. G.

Crystallographic investigations in the terpene group. G. GIACOMELLO (Z. Krist., 1938, **99**, 89—94; cf. A., 1937, II, 201).—A single-crystal *X*-ray analysis of the dehydrogenation product (I) (0·5 mg.) of gypsogenin and related triterpenes (Ruzicka, A., 1934, 530) gives a monoclinic unit cell with *a* 8·16, *b* 6·36, *c* sin β 14·92 A., β 84°; $\rho_{mol.}$ 1·316; mol. wt. 308·7±3 (therefore $C_{24}H_{18}$, not $C_{25}H_{20}$); space-group $P2_1$. A Patterson analysis using intensities from Weissenberg photograms confirms the picene nucleus, the plane skeleton (of regular hexagons) of which is inclined at 28° to the *bc* plane, with its longitudinal axis parallel to the *c* axis. (I) is 1 : 8-dimethylpicene. I. McA.

Crystal structure of 9 : 10-dihydroanthracene and 9 : 10-dihydro-1 : 2 : 5 : 6-dibenzanthracene. J. IBALL (J.C.S., 1938, 1074—1077).—The crystal structure of 9 : 10-dihydroanthracene (I) and of 9 : 10-dihydro-1 : 2 : 5 : 6-dibenzanthracene (II) has been investigated by *X*-rays. The crystals of (I) are short prisms with *a* 7·70, *b* 6·21, *c* 11·09 A., β 113°, and 2 mols. per unit cell. The most probable space-group is C_2^2—*P*2, which does not indicate whether the mol. has planar configuration or one in which rings are inclined to each other. (II) crystallises in two forms

(i) and (ii), each having m.p. 218—219° (uncorr.). (i) has a 14·24, b 5·27, c 24·90, d (001) 18·98 A., β 130·2°, and 4 mols. per unit cell. The crystals show positive birefringence. The space-group is C_{2h}^5—$C2/c$ and the mol. has a centre of symmetry. Form (ii) has a 9·49, b 6·76, c 24·38, d (001) 22·70 A., β 111·4°. The unit cell has 4 mols. and the space-group is C_{2h}^5—$B2_1/c$ indicating the presence of a centre of symmetry and a planar configuration. W. R. A.

Crystal structure of succinic acid. H. J. Verweel and C. H. MacGillavry (Nature, 1938, **142**, 161—162).—The low-temp. form of the acid has a 5·10, b 8·88, c 7·61 A., β 133° 37′ (cf. A., 1924, ii, 382; 1931, 1036); space-group C_{2h}^5—$P2_1/a$, with 2 mols. per unit cell. The crystal shows pronounced fibre cleavage along the c axis, which is also the direction of the largest n, indicating that the mol. lies along the axis. The C—C distances are 1·52 and 1·51 A., the calc. C—O distances 1·28 and 1·31 A., the O—O distance in the same mol. 2·28 A., and the distance between O atoms in different mols. 2·65 A. L. S. T.

Crystallographic investigation of the complex salt of 1 : 2 : 4-triazole with cupric chloride. E. Sanero (Periodico Min., 1936, **7**, 171—177; Chem. Zentr., 1936, ii, 1492).—$C_2H_3N_3,CuCl_2$, monoclinic-prismatic, has $a : b : c = 0·59758 : 1 : 0·62553$, β 96° 23′ 40″ (goniometer). X-Ray rotation diagrams give a 6·92, b 11·58, c 7·24 A.; ρ 2·362 gives 4 mols. per unit cell. L. S. T.

Crystal structure of diketopiperazine. R. B. Corey (J. Amer. Chem. Soc., 1938, **60**, 1598—1604).—X-Ray examination shows that 2 : 5-diketopiperazine has a simple monoclinic unit of 2 mols.: a_0 5·19, b_0 11·50, c_0 3·96 A., β 83°. The space-group is C_{2h}^5—$P2_1/a$. The mol. is a nearly flat, hexagonal ring, with a centre of symmetry; the angle between all linkings is 120±3°. Interat. distances in the mol. are: C—C 1·47, C—O 1·25, C—N 1·33, N—C(H_2) 1·41 A. (each ±0·03 A.) The mols. are held together by H linkings to form long, parallel chains. E. S. H.

Submicroscopic twinning. G. Menzer (Naturwiss., 1938, **26**, 385—387).—The effect of submicroscopic twinning of crystals such as is found in the deposition of Ag and Ni on rock-salt on X-ray and electron diffraction patterns is considered. A. J. M.

Structure of oxidised silicon film. H. Kamogawa (Physical Rev., 1938, [ii], **54**, 91).—Electron diffraction photographs were obtained by the transmission of 0·058—0·063 A. electrons through thin Si films produced by condensing Si vapour on polished rock-salt which is afterwards dissolved in H_2O. The diffraction patterns differed from those of Si crystal and indicate that the film changes to amorphous SiO_2 by spontaneous oxidation (cf. Warren, A., 1934, 834). Changes of pattern on heating the film over 410—800° are described. N. M. B.

Electron-diffraction study of digermane and trigermane. L. Pauling, A. W. Laubengayer, and J. L. Hoard (J. Amer. Chem. Soc., 1938, **60**, 1605—1607).—The Ge—Ge linking distance in Ge_2H_6 and Ge_3H_8 is 2·41±0·02 A. E. S. H.

Magnetically oriented bismuth. A. Altma (Ann. Physik, 1938, [v], **32**, 489—506).—Bi powder is oriented with the principal crystal axis in the direction of the field if allowed to fall freely in a magnetic field. Solid blocks obtained by pressing together such oriented powder show, when rotated in magnetic field, the periodic variation in electrical resistance characteristic of a single crystal. The influence of tempering before and after orientation and of the size of the powder particles on the properties of such blocks has been investigated. A method of obtaining oriented single crystals of Bi in vac. and without seeding is described. Orientation does not take place when liquid Bi is allowed to crystallise in magnetic field except when the nucleus of crystallisation is able after formation to rotate freely in the field. O. D. S.

Derivation and nomenclature of 32 crystal classes. H. Tertsch (Zentr. Min., 1936, **A**, 161—166; Chem. Zentr., 1936, ii, 1509). L. S. T.

Effect of temperature on the modulus of elasticity of ferromagnetic substances. W. Döring (Ann. Physik, 1938, [v], **32**, 465—470).—The effect of temp. on the modulus of elasticity (E) of a Fe–Ni alloy with 42% Ni at different field strengths is discussed. The curve of E against temp. shows a break at the Curie temp. which is not observed with alloys of other composition. The anomaly can be explained as a consequence of the vol. magnetostriction, which is particularly great for this alloy. A. J. M.

Elastic properties of sodium wires between −183° and 90°. R. H. V. M. Dawton (Proc. Physical Soc., 1938, **50**, 483—495).—The torsion and extension moduli of single-crystal wires and polycryst. Na were investigated by means of a special apparatus. Results for single crystals are in good agreement with the theory due to Fuchs (cf. A., 1937, I, 124). The characteristic temp. is calc. from the data for polycryst. Na and is compared with X-ray measurements previously reported (cf. *ibid.*, 399). N. M. B.

Gallium, indium, and thallium. E. Einecke (Z. anorg. Chem., 1938, **238**, 113—174).—Some physical properties of Ga have been studied and compared with those of Al, In, and Tl. The hardness on Moh's scale is approx. 2·5, and relative vals. obtained by the Martens method are Ga : In : Tl = 2·9 : 1 : 1·1. A simple method for obtaining single-crystal wires of easily fusible metals is described. In the behaviour of these under tensile stress, Ga closely resembles Zn. A procedure by which Ga can be welded is described. The linear rate of crystallisation inversely ∝ the diameter of the tube, and is abnormally low near the m.p. but rises rapidly when the degree of undercooling increases beyond 10° and is still not a max. at −80°. In presence of a protective colloid Ga can be dispersed by sparking to a very stable brown sol. The behaviour of Ga on anodic polarisation, and the electrolytic reduction of Ga_2O_3, In_2O_3, and Tl_2O_3, have been studied. Ga electrodes under suitable conditions exhibit valve action approx. equal to that of Al. F. J. G.

Internal friction in solids. V. Macroscopic eddy currents. C. ZENER (Physical Rev., 1938, [ii], **53**, 1010—1013; cf. A., 1938, I, 305).—Mathematical. The internal friction is calc. for all frequencies for both longitudinal and transverse vibrations, and the theory of internal friction due to macroscopic eddy currents is shown to be identical with that due to macroscopic thermal currents. N. M. B.

Atomistic principles of crystal plasticity. A. KOCHENDÖRFER (Z. Metallk., 1938, **30**, 174—178).—From theoretical considerations the results of which have been confirmed by experiments on the plastic deformation of various metals and $C_{10}H_8$ it is shown that the true hardening produced by deformation is the resultant of the small shear stresses set up in the mosaic boundaries of the real crystals by the external stress applied, and is therefore determined by the equilibrium between the formation and relief of the lattice distortions which is controlled by the temp. and the rate of slip. A. R. P.

Cathodic sputtering. U. K. BOSE (Indian J. Physics, 1938, **12**, 95—108).—A quant. study has been made of the relation between sputtering and pressure. The curve has a max. and above the optimum pressure corresponding with this the sputtering decreases hyperbolically, whilst below it falls very rapidly. The sputtered particles form a pseudo-gas. Figures are given for the approx. pressure, current, length of dark space, and time of exposure required to produce films of Cu, Ag, Ni, Fe, and Al. T. H. G.

Ounce mol. wt. of a gas. (A) J. STRACHAN. (B) H. V. THOMPSON (Nature, 1938, **141**, 977, 977—978; cf. A., 1938, I, 352). L. S. T.

Variation of electrical conductivity of the atmosphere with height. D. C. ROSE (Canad. J. Res., 1938, **A**, **16**, 107—130).—The conductivity of the atm. has been determined at heights up to 16,000 ft. during aeroplane flights. The conductivity increases rapidly with height. Between 1000 and 10,000 ft. positive and negative conductivities were equal, but above 10,000 ft. the negative conductivity predominated. A. J. M.

Optical constants, electrical resistance, and structure of thin metal layers. J. KRAUTKRÄMER (Ann. Physik, 1938, [v], **32**, 537—576).—Measurements have been made of the variation in optical consts. and electrical resistance of thin films of Au and Ag on fused quartz with the thickness, from 2 to 28 mμ., and temp. of prep. of the films. The structure of the films has been investigated by electron diffraction. It is concluded that the films are not amorphous but are composed of small crystallites. O. D. S.

Gyromagnetic effect in superconductors. I. K. KIKOIN and S. V. GOOBAR (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 249—251).—Since a superconductor placed in a magnetic field possesses the greatest conceivable diamagnetic susceptibility the existence of a gyromagnetic effect in diamagnetic Pb has been demonstrated experimentally by a method which is briefly described. W. R. A.

Effects of gas ions on the Benedicks effects in mercury. C. BENEDICKS and P. SEDERHOLM (Nature, 1938, **141**, 1097).—The e.m.f. that appears with a temp. gradient in liquid Hg changes its sign from negative for ordinary Hg to positive for pure degassed Hg. A positive Thomson effect also can be expected in pure Hg freed from gas, bringing Hg into line with Zn and Cd. L. S. T.

System of units for electricity and magnetism. F. ODONE (Nuovo Cim., 1935, [ii], **12**, 551—575; Chem. Zentr., 1936, ii, 31).—Theoretical. J. S. A.

Atomic moment of quadrivalent rhenium. N. PERAKIS, T. KARANTASSIS, and L. CAPATOS (Compt. rend., 1938, **206**, 1369—1371; cf. A., 1934, 1294; 1936, 278).—Vals. of χ at 80—300° K. and of the Curie points for K_2ReCl_6, K_2ReBr_6, and Cs_2ReCl_6 are recorded. Re^{IV} possesses variable paramagnetism of the Weiss type, the mean at. moment being 18·95 Weiss or 3·83 Bohr magnetons, in agreement with the val. (19·17 Weiss magnetons) calc. from the moment of Re^{VII}. A. J. E. W.

Precise measurements of the magnetic susceptibilities of rare earths by Faraday's method. B. CABRERA (J. Phys. Radium, 1938, [vii], **9**, 209—227).—With suitable precautions, which are discussed, it is claimed that the accuracy of Faraday's method is 1 in 1000. Recorded data on the rare earths are examined. Weiss' law agrees better with experimental vals. than the theory of Hund and Van Vleck. W. R. A.

Magnetic anisotropy of ferromagnetic crystals in weak fields and reversible susceptibility. E. KONDORSKI (Physical Rev., 1938, [ii], **53**, 1022; cf. A., 1938, I, 183).—Mathematical. N. M. B.

Dependence of magnetic susceptibility of Sm^{+++} on temperature between 293° and 800° K. O. E. FRIVOLD and L. LUNDE (Physikal. Z., 1938, **39**, 571—574).—The susceptibility of Sm_2O_3 between 293° and 800° K. was determined by measuring the force exerted on a sample placed in a non-homogeneous magnetic field. The ionic susceptibility of Sm^{+++} was obtained from the mass susceptibility of Sm_2O_3. The curve of ionic susceptibility against temp. shows a min. at approx. 370° K. The magneton no. $\propto$ temp. A. J. M.

Diamagnetism of cadmium. S. R. RAO and S. SRIRAMAN (Proc. Roy. Soc., 1938, **A**, **166**, 325—341).—The principal magnetic susceptibilities of single crystals are measured by the Gouy method; vals. perpendicular and parallel to the hexagonal axis are −0·163 and −0·223. The influence of cold work on polycryst. rods is to decrease the susceptibility; single crystals are not affected. The addition of small quantities of Pb causes $\chi_\perp$ to diminish, $\chi_\parallel$ remaining unchanged. Addition of Zn has no effect on the susceptibility. G. D. P.

Loss in magnetic materials. R. GOLDSCHMIDT (Helv. Phys. Acta, 1938, **11**, 329—338).—The magnetic energy loss (after-effect loss) of an alloy containing approx. 66% Fe, 33% Ni, 1% Cu with a Curie point somewhat >100° was determined for weak fields. For specimens of permeability 58—690 the hysteresis loss angle e_h agrees well with the theoretical relationship $2\nu/\mu = 3\pi e_h/4$ (μ = permeability). The

a.c. loss, however, does not agree with the val. calc. from the Maxwell equations, being about twice as great as this. The effect of temp. on the permeability and loss was determined. The max. of the loss always occurs at a higher temp. than the max. of the permeability. A. J. M.

Influence of cold-work and heat-treatment on the electrical and magnetic properties of pure nickel. II. Twisted and stretched nickel wire. H. BITTEL (Ann. Physik, 1938, [v], **32**, 608—624; cf. B., 1938, 387).—Measurements have been made of the electrical resistance and magnetisation curve of Ni under varying conditions of elastic and plastic twisting, and of their recovery on annealing. Results are interpreted in accordance with ferromagnetic theory. O. D. S.

Magnetic properties of diamagnetic salts during lattice changes. G. E. R. SCHULZE (Z. physikal. Chem., 1938, **40**, **B**, 308—317).—Measurements have been made of the changes in the magnetic susceptibilities of NH_4NO_3, NH_4Br, KNO_3, $TlNO_3$, AgI, and Ag_2S at their transition points. The effects are so small that they can be due only to the altered at. arrangements, and not to changes in the at. states. T. H. G.

Magnetic properties of thin layers of vaporised iron. K. R. DIXIT (Physikal. Z., 1938, **39**, 580—582).—An attempt has been made to obtain Fe in such a form that the tendency of the atoms to form large groups, to which, according to the Heisenberg theory, ferromagnetism is to be ascribed, is prevented. Thin layers of Fe were obtained by vaporisation in vac. on to freshly split mica surfaces. Such thin layers (10^{-6} cm. thick) did not rapidly oxidise in dry air. The magnetic properties of layers of different thicknesses were determined. Layers >200 atoms thick are quite isotropic, and some showed hysteresis phenomena. Thinner layers often showed magnetic anisotropy. The magnetic properties begin to change when the layers are 100 atoms thick, and the changes reach their limit at a thickness of 30 atoms. A. J. M.

Photomagnetic effect. O. SPECCHIA (Nuovo Cim., 1935, [ii], **12**, 549—550; Chem. Zentr., 1936, ii, 33).—The results of Bose and Raha (A., 1935, 915) are confirmed. J. S. A.

Measurements on the velocity and the absorption of sound in gaseous nitric oxide in a magnetic field. A. VAN ITTERBEEK and L. THYS (Physica, 1938, **5**, 640—642).—Absorption of sound in NO is not influenced by a magnetic field of 5000 gauss. The variation of the absorption with pressure is in accord with the Kirchhoff–Helmholtz theory. The velocity of sound in NO for a frequency of 600 kc. per sec., at 16·3°, is 333·9 m. per sec. A. J. E. W.

Measurements on the velocity of sound as a function of pressure in oxygen gas at liquid oxygen temperatures. Calculation of the second virial coefficient and the specific heats. A. VAN ITTERBEEK and O. VAN PAEMEL (Physica, 1938, **5**, 593—604; cf. A., 1932, 13).—An acoustical interferometer for use at liquid O_2 temp. using frequencies of ~400 kc. per sec. is described, and vals. of the velocity of sound in O_2 (v) at 78—90° K. and 5—75 cm. pressure are recorded. v is expressed by a formula involving p, T, c_v, the second virial coeff. B, and γ for an ideal gas. An expression for B in terms of T (75—200° K.) is derived, and γ, c_v, and c_p for O_2 at 78—90° K. are expressed as functions of p. A. J. E. W.

Velocity of sound at frequencies of 7·5 and 1·5 × 10^6 Hz. in liquid oxygen as a function of the b.p. H. W. LIEPMANN (Helv. Phys. Acta, 1938, **11**, 381—396).—Measurements were made by determining the diffraction of light by supersonic waves. Suitable apparatus is described. The following results were obtained at −183° and −210°, respectively: velocity of sound, 911±4 and 1130±10 m./sec.; adiabatic compressibility, 1·072 and 0·614 × 10^{-10} cm.^{2}/dyne; isothermal compressibility, 1·812 and 1·089 × 10^{-10} cm.^{2}/dyne; ratio of sp. heats 1·70 and 1·79. T. H. G.

Theory of the transmission of supersonic waves through a solid plate. F. LEVI and N. S. N. NATH (Helv. Phys. Acta, 1938, **11**, 408—431).—Chiefly mathematical. A new treatment alternative to that of Reissner. The coeffs. of reflexion and refraction at a single boundary between the solid plate and the liquid medium in which it is immersed are first derived. The problem is then one of summing the multiple reflexions and refractions. T. H. G.

[Some] simple special cases for the transmission of supersonic waves through thin plates. R. BÄR (Helv. Phys. Acta, 1938, **11**, 397—407).—Observations on communications by Bär, Reissner, and Walti (cf. A., 1936, 446; 1938, I, 351). Four special cases are discussed mathematically in which only a single forward and a single reverse wave are transmitted. They give such simple expressions that they should be suitable for experimental tests of the theory. T. H. G.

Electric and magnetic birefringence of liquids. A. GOLDET (Ann. Physique, 1938, [xi], **10**, 103—172).—The magnetic birefringence of C_6H_6 and about 20 of its derivatives was investigated over a wide temp. range, and, in the case of C_6H_6 vapour, up to 10 atm. pressure. When the crit. temp. and pressure of a pure substance could not be reached measurements were made for liquid mixtures having a crit. miscibility point. The magnetic and electric birefringence show a sharp increase in the neighbourhood of this point. For the pure substances Cotton–Mouton consts. are plotted as a function of temp. Measurements at room temp. are reported for the first time for several org. substances, and at low temp. for some liquefied gases. Vals. of n obtained by a special apparatus at high and low temp. show marked discrepancies from those predicted by the theory of mol. orientation. Similar anomalies in the case of the Kerr effect and the depolarisation of scattered light are discussed. N. M. B.

Le Chatelier Q–t diagram and apparent specific heats. RIBAUD (Chaleur et Ind., 1938, **19**, 63—68; cf. B., 1938, 124).—A review. R. B. C.

Heat capacity of Rochelle salt. A. J. C. WILSON, J. F. G. HICKS, and J. G. HOOLEY (Physical Rev.,

1938, [ii], **54**, 87).—Investigations made by the method of adiabatic electric heating and with a Nernst-type vac. calorimeter in a range including both Curie points show that any anomaly near these points is <1% (cf. A., 1935, 1454). N. M. B.

Heat capacities of a few crystals at low temperatures. S. C. SIRKAR and J. GUPTA (Indian J. Physics, 1938, **12**, 145—154).—The heat capacities of crystals of NH_4Cl, CO_2, S, and C_6H_6 at low temp. have been studied to discover whether the Debye functions corresponding with the newly observed low-frequency Raman lines of these crystals contribute to the vals. of C_p. For NH_4Cl a Debye function corresponding with the line 183 cm.$^{-1}$ and an Einstein function for the angular oscillation explain the vals. of C_p satisfactorily, whilst for the other compounds the Einstein functions of the new lines are required. In the case of C_6H_6 this fact, and also the selection rules governing the appearance of Raman lines due to lattice oscillations, show definitely that the new lines are not due to these oscillations. T. H. G.

Heat capacities and energies of $SiCl_4$, $TiCl_4$, and $SnCl_4$. R. C. HERMAN (J. Chem. Physics, 1938, **6**, 406).—Utilising recorded frequencies for $SiCl_4$, $TiCl_4$, and $SnCl_4$, C_p has been calc. from 0° to 300°. W. R. A.

Phase equilibrium in hydrocarbon systems. Thermodynamic properties of *iso*butane. B. H. SAGE and W. N. LACEY (Ind. Eng. Chem., 1938, **30**, 673—681).—Isochoric heat capacities of *iso*butane in the two-phase region have been measured at 21—105° together with latent heats of vaporisation up to 77°, Joule-Thomson coeffs. from 21° to 121°, and sp. vols. in the single-phase region at pressures from 1 atm. to 3000 lb. per sq. in. over the same temp. range. V.p. have also been measured from 21° to 121°. From these primary data, the variation in enthalpy, entropy, and fugacity with temp. and pressure have been calc. and results are tabulated and graphed. C. C.

Entropy of carbon monoxide. R. KAISCHEW (Z. physikal Chem., 1938, **40**, **B**, 273—280).—Using a special vac. calorimeter, thermal measurements have been made on CO condensed directly from gas phase. The structure of the CO crystal near the transition point is not noticeably influenced by slow crystallisation from the gas. The heat of transition is 150·9 g.-cal. per mol. and the latent heat of fusion 200·9 g.-cal. per mol. The transition point is 61·5° and the m.p. 68·1° K. T. H. G.

Hindered rotation of the methyl groups in propane. Heat capacity, vapour pressure, heats of fusion and vaporisation of propane. Entropy and density of the gas. J. D. KEMP and C. J. EGAN (J. Amer. Chem. Soc., 1938, **60**, 1521—1525).—Heat capacities from 15° K. to the b.p. are recorded. C_3H_8 has m.p. 85·45±0·05° K., b.p. 231·04±0·05° K., heat of fusion 842·2±0·8 g.-cal. per mol., heat of vaporisation 4487±4 g.-cal. per mol., *d* (at 298·10° K. and 1 atm.) 1·8325±0·0007 g. per litre, v.p. (liquid at 166—231° K.) $\log_{10}P_{(\text{int. cm. Hg})} = -(1325{\cdot}358/T) + 9{\cdot}64920 - 0{\cdot}0118950T + 0{\cdot}0000134207T^2$. The experimental entropy at the b.p. and 1 atm. is 60·45±0·10 g.-cal. per degree per mol. The entropy calc. with the assumption of free internal rotation minus the experimental entropy is 3·40±0·3 g.-cal. per degree per mol., corresponding with a potential barrier of 3300±400 g.-cal. per mol. hindering the internal rotation of Me. The entropy (ideal gas, with a 3300 g.-cal. per mol. barrier) at 1 atm. and 298·10° K. is 64·7±0·3 g.-cal. per degree per mol. (nuclear spin entropy not included). E. S. H.

Relation between molecular latent heats of fusion and rotation of molecules in crystal lattices. C. FINBAK (Tids. Kjemi, 1938, **18**, 101—102; cf. A., 1938, I, 68).—Increase of *L* for long > flat > spherical mols. is not due to van der Waals forces. Spherical (and to some extend flat) mols. normally rotate in the crystal lattice, and thus already possess part of the rotational energy necessary for fusion. Spherical mols. give similar *X*-ray diagrams in both phases. M. H. M. A.

Supercooling and freezing of water. N. E. DORSEY (J. Res. Nat. Bur. Stand., 1938, **20**, 799—808).—For specimens of H_2O sealed in glass bulbs, freezing occurs spontaneously at a definite temp. characteristic of the specimen, although abnormal behaviour is not uncommon. This spontaneous f.p. may be altered by sedimentation and lowered by preheating the liquid, this latter being a lasting effect, persisting for months. Observations are consistent with the idea that freezing is determined by motes suspended in the H_2O, and in particular by the size of the largest mote present. Neither extreme quiescence nor a diminutive vol. of H_2O is essential for supercooling. M. R.

Artificial production of snow crystals. M. PERUTZ (Nature, 1937, **140**, 345; 1938, **142**, 10—12). A summary of the most recent work of Nakaya *et al.* L. S. T.

Melting and structure of long-chain ketones. A. R. UBBELOHDE and J. W. H. OLDHAM (Nature, 1938, **142**, 74—75).—Graphs showing the relation between the setting points and the positions of the CO dipole for isomeric ketones $C_{17}H_{34}O$ and $C_{18}H_{36}O$ are reproduced. The setting points depend on the position of the CO dipole in the long-chain mol. An explanation in terms of a mechanical model is discussed. L. S. T.

F.p. of methyl alcohol. Cryostat applicable to f.p. determinations. E. E. ROPER (J. Amer. Chem. Soc., 1938, **60**, 1693—1695).—Apparatus for the determination of f.p. below 0° is described. MeOH has f.p. −97·68±0·02°. The f.p.–*d* relation is discussed. E. S. H.

Spectra and chemical activity of rare gases. X. Changes in density of platinum by the chemical and physico-chemical action of helium and influence of temperature on density of the products. J. PIAZZA and H. DAMIANOVICH (An. Soc. cient. argent., 1935, **120**, 207—209; Chem. Zentr., 1936, ii, 737).—The decrease in *d* of Pt produced by the action of He is verified. By heating at 330—450° *d* again increases to the val. 21. H. J. E.

Density of fused alumina. H. VON WARTENBERG, G. WEHNER and E. SARAN (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 73—75; Chem. Zentr., 1936, ii, 444).—From the size of freely falling drops of fused Al_2O_3, which was recorded photographically, d at the m.p. $= 2{\cdot}54 \pm 0{\cdot}04$. On fusion a 30% expansion occurs. H. J. E.

Comparison of density of tap-water of Osaka, Japan, and of Cambridge, U.S.A. T. TITANI and N. MORITA (Bull. Chem. Soc. Japan, 1938, **13**, 409—418).—The densities of purified H_2O from the two sources were identical within $\pm 0{\cdot}2\gamma$. Small changes in density due to fractional distillation and dissolution of air were detected. H. J. E.

Deuterium–protium ratio in ordinary water. N. MORITA and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 419—426; cf. A., 1936, 1078).—The density of Osaka and Cambridge, U.S.A., tap-waters at 95° was $16{\cdot}9 \pm 0{\cdot}5\ \gamma >$ that of D-free H_2O prepared from them by fractional electrolysis. The D : H ratio in the tap-H_2O was $1 : 6200 \pm 200$. H. J. E.

Limiting density of SO_2 gas. At. wt. of sulphur. E. MOLES, (MLLE.) T. TORAL, and A. ESCRIBANO (Compt. rend., 1938, **206**, 1726—1728).—Measurements of the limiting density made in apparatus of two different types of glass, giving different adsorption corrections, give the at. wt. of S as 32·062 and 32·063, respectively. A. J. E. W.

Fugacity of gaseous and liquid methane. L. G. SANIEV (Prom. Org. Chim., 1938, **5**, 350—353).—Formulæ for calculating the fugacity of CH_4 are derived, and a nomogram is given. R. T.

Vapour pressure of propane. P. HARTECK and R. EDSE (Z. physikal. Chem., 1938, **182**, 220—224).—The v.p. curve of C_3H_8 has been studied. The b.p. is $-41{\cdot}14 \pm 0{\cdot}01°/760$ mm. and the heats of vaporisation at $-48°$ and $-100°$ are 4704 ± 7 and 5060 ± 10 g.-cal., respectively. T. H. G.

Calculation of the perfect gas constant for water vapour with the aid of the experimental results adopted by the International Conference of Tables of Water Vapour. P. TONGAS (Compt. rend., 1938, **207**, 48—50; cf. A., 1937, I, 71).—The ratio $(pv)_0/T$, where $(pv)_0$ is the limiting val. of pv (p, pressure; v, sp. vol.) when $p = 0$, and T is abs. temp., is const. from 200° to 550°. W. R. A.

Thermal expansion of crystalline sodium between 80° and 290° K. S. SIEGEL and S. L. QUIMBY (Physical Rev., 1938, [ii], **54**, 76—78).—Data obtained at 10° intervals, using special expansion and cryostatic apparatus, are tabulated and plotted. Results agree with Grüneisen's relation between thermal expansion and heat content. N. M. B.

Determination of coefficients of expansion by the powder and rotating-crystal methods. M. STRAUMANIS and A. IEVIŅŠ [with K. KARLSON] (Z. anorg. Chem., 1938, **238**, 175—188).—Apparatus for precision measurements is described, and the following vals. of $\alpha \times 10^6$ at 15—70° are recorded: NaCl, 40·49; Al, 23·31; LiF, 34·17; LiCl, 44·76; NaBr, 42·52; TlCl, 54·57; TlBr, 51·20; β-Sn, (vertical to c axis) 16·77, (parallel to c axis) 32·24; $Co[Hg(CNS)_4]$, (vertical to c axis) −10·85, (parallel to c axis) 149·29. The lattice consts. of $Co[Hg(CNS)_4]$ differ slightly from crystal to crystal, but all crystals have the same α. F. J. G.

Statistical mechanics of condensing systems. M. BORN and K. FUCHS (Proc. Roy. Soc., 1938, **A**, **166**, 391—414).—A mathematical analysis shows that the exact evaluation of the partition function for a system of equal particles exerting central forces leads to the complete thermodynamics of a gas. The theory explains not only the phenomenon of condensation but also the possibility of the existence of different condensed phases. G. D. P.

Coefficient of thermal conductivity of gases. P. GUARESCHI (Atti R. Accad. Lincei, 1938, [vi], **27**, 92—101; cf. A., 1938, I, 239).—Following on previous papers, an expression for the thermal conductivity coeff. of gases is derived. O. J. W.

Thermal conductivities of mercury, sodium, and sodium amalgams in the liquid state. W. C. Hall (Physical Rev., 1938, [ii], **53**, 1004—1009).—A guard-ring method described for the measurement of thermal conductivities of liquid metals allows frequent and easy replacement of specimens, a layer of paraffin over the liquid metal prevents oxidation by air, and the furnace automatically attains equilibrium. The thermal conductivities of Hg, Na, and Na–Hg of concn. 70—94 at.-% Na were measured for the temp. ranges Hg 40—220°, Na 85—210°, and Na–Hg 100—150°. Na behaves normally, but Hg and the amalgams are abnormal. Breaks in the conductivity–concn. curve indicate the existence of Na_5Hg_2, and a eutectic at 86·5 at.-% Na is shown. Lorentz nos. for Na and Hg are calc. N. M. B.

Heat transport in liquid helium below 1°. N. KÜRTI and F. SIMON (Nature, 1938, **142**, 207).—Experiments with liquid He between 0·2° and 0·5° K. indicate that the anomalous heat conduction and surface film flow disappear at these temp. L. S. T.

Heat conductivity of liquid oxygen, liquid nitrogen, and their mixtures. G. HAMMANN (Ann. Physik, 1938, [v], **32**, 593—607).—The heat conductivities of liquid O_2 and N_2 at −200° are respectively $4{\cdot}98 \times 10^{-4}$ and $4{\cdot}96 \times 10^{-4}$ g.-cal. per cm. per sec. per degree. The conductivities of their mixtures are < those of the pure components with a min. val. (45% O_2) $4{\cdot}60 \times 10^{-4}$ g.-cal. per cm. per sec. per degree at −200°. O. D. S.

Relativistic study of the Joule–Thomson effect and adiabatic processes in a gas. II. D. V. GOGATE (Phil. Mag., 1938, [vii], **26**, 166—173; cf. A., 1938, I, 304).—Mathematical. The Joule–Thomson effect and adiabatic processes are studied in a relativistic degenerate gas, degenerate in the sense of Fermi–Dirac statistics. W. R. A.

Compressibility coefficient of solids. P. GUARESCHI (Atti R. Accad. Lincei, 1938, [vi], **27**, 90—91; cf. A., 1938, I, 233).—The expression $K = 1{\cdot}08 \times 10^{23} \times M\delta^5$, where K = compressibility coeff., M = at. or mol. wt., δ = diameter of at. or mol. action, is derived and used to calculate the vals. of

K for 15 metals. The results agree fairly well with observed vals. O. J. W.

Improved calculation of the energies of metallic Li and Na. J. BARDEEN (J. Chem. Physics, 1938, **6**, 367—371).—Theoretical. Energies of metallic Li and Na have been calc. by a modification of the method of Wigner and Seitz (A., 1933, 660; 1934, 1283). Calc. vals. of lattice consts., heats of sublimation, and compressibilities are in fair agreement with experiment. W. R. A.

Compressibilities of the alkali metals. J. BARDEEN (J. Chem. Physics, 1938, **6**, 372—378; cf. preceding abstract).—The method of Wigner and Seitz has been tested by determination of the pressure variation of the compressibilities of alkali metals. The results for Na agree with experimental data but the calc. vals. for Li are approx. 15% too high. The polymorphic transition of Cs at 22,000 kg. per sq. cm. is probably a transition from the normal body-centred to a more close-packed, face-centred form arising from non-electrostatic interaction energy of the ions. W. R. A.

Viscosity of hydrocarbon solutions (liquid and gaseous propane). B. H. SAGE and W. N. LACEY (Ind. Eng. Chem., 1938, **30**, 829—834).—Data are given for the effect of pressure on the viscosity of liquid and gaseous C_3H_8 at temp. between 37° and 105°. E. G. H.

Viscosity of liquid helium II. E. F. BURTON (Nature, 1938, **142**, 72).—Measurements of the rate of flow of He II through capillaries at temp. near the λ-point and at 2·16° K. are reproduced graphically. At 2·16° K., η for He is $\sim 5{\cdot}4 \times 10^{-5}$ to $7{\cdot}9 \times 10^{-5}$ c.g.s. unit. No indication of "superfluidity" was obtained. The results disagree with those of Allen and Misener (A., 1938, I, 131) and Kapitza (*ibid.*, 131). L. S. T.

Viscosity of liquid helium II. W. F. GIAUQUE, J. W. STOUT and R. E. BARIEAU (Physical Rev., 1938, [ii], **54**, 147).—Factors arising from surface films which affect η for He below 2·19° K. (He II) are discussed, and a preliminary report of measurements obtained by a method designed to overcome the difficulty is given. N. M. B.

Dependence of the viscosity of fluids on the molecular volume, and an application of the principle of the continuity of state. D. T. LEWIS (J.C.S., 1938, 1061—1066).—The η of gases depends on the mol. wt. and the mol. cross-sectional area. The derived parachor equation accounts satisfactorily for the behaviour of fluids in general, thus emphasising the importance of the principle of the continuity of state. The general equation gives directly Andrade's equation for the variation of the η of a simple substance with temp. The dependence of the consts. of this equation on the mol. wt. and cross-sectional area is demonstrated. W. R. A.

Correlation of intermolecular forces with fluidity and density data. J. N. FRIEND (Trans. Faraday Soc., 1938, **34**, 813—816).—Arguments from η and d data for non-associated org. liquids support the view that the attractive force between mols. is $\propto$ (intermol. distance)$^{-8}$. F. L. U.

Guggenheim's theory of strictly regular binary liquid mixtures. G. S. RUSHBROOKE (Proc. Roy. Soc., 1938, **A**, **166**, 296—315).—An extension of the theory leads to an expression for the configurational energy of the mixture. The conditions under which solutions may be expected to exhibit crit. mixing phenomena, and the variation with temp. of the concn. at which the mixture separates into two phases, are discussed. G. D. P.

Viscosity of binary liquid mixtures. G. HUGEL and N. TCHERKEZOFF (XIV Congr. Chim. ind. Paris [1934], 1935, Comm. I, 11 pp.; Chem. Zentr., 1936, ii, 273).—A theoretical expression is derived which accords with the data for hexane-*cyclo*hexane mixtures. H. J. E.

Equation for the viscosity of mixtures. S. K. CHAKRABERTTY and P. B. GANGULY (Proc. Nat. Acad. Sci. India, 1937, **7**, 205—217).—The expression $\log \eta - \frac{1}{3} \log \rho = C_1 + C_2 x_2$, where C_1 and C_2 are consts. and x_2 is the mol. fraction of solute, has been derived from Andrade's equation (cf. A., 1934, 356). Data for η and ρ have been determined for the systems phenetole–Ph_2O, EtOBz–$CH_2Ph{\cdot}OBz$ (I), EtOAc–EtOBz, phenetole–Et_2O, Et_2O–Ph_2O, EtOAc-(I). C_6H_6–EtOBz, PhMe–EtOBz, PhMe-(I), C_6H_6-(I). $C_2H_4Cl_2$–$C_2H_4Br_2$, $CCl_3{\cdot}CO_2H$–$COMe_2$, AcOH–$COMe_2$, PhOH–C_6H_6, PhOH–$COMe_2$, $CCl_3{\cdot}CO_2H$–AcOH, AcOH–EtOBz, and AcOH–EtOAc. In many systems a linear relation in accordance with the above equation is obtained, but marked deviation occurs with systems characterised by polar and dissimilar components. The deviations are ascribed to loose compound formation. In many of the systems the vals. are in better agreement with the equation of MacLeod (A., 1924, ii, 280). E. S. H.

Degree of depolarisation of the scattered light from binary liquid mixtures. II. H. FLASCHKA and E. GASTINGER (Monatsh., 1938, **72**, 52—57).—A small negative deviation from additivity is shown by hexane–decahydronapthalene mixtures, and larger deviations, respectively negative and positive, by *m*-cresol–NH_2Ph and by allylthiocarbimide–piperidine mixtures. (Cf. A., 1938, I, 394.) O. D. S.

Vapour pressure. I. Evidence for the validity of Raoult's law. Systems benzene–diphenyl, benzene–benzyl benzoate, ethyl acetate–benzyl benzoate. H. H. GILMANN and P. GROSS (J. Amer. Chem. Soc., 1938, **60**, 1525—1530).—Total v.p. measurements have been made at 50—95° over limited concn. ranges. The systems C_6H_6–Ph_2 and C_6H_6–$CH_2Ph{\cdot}OBz$ (I) behave in accordance with Raoult's law, but with EtOAc-(I) small positive deviations occur. The causes of the deviations are discussed. E. S. H.

B.p. of mixtures of water and ethyl alcohol. P. VIDAL (Bull. Assoc. Chim. Sucr., 1938, **55**, 554—564).—Equations connecting the composition of the liquid and the composition of the vapour with the b.p. have been derived. I. A. P.

Structure of silica glass and of the potash silicate glasses. G. HARTLEIF (Z. anorg. Chem., 1938, **238**, 353—384).—The abs. intensities of *X*-ray interferences for SiO_2 glass and for glasses with 15,

25, and 35% K_2O have been measured and subjected to Fourier analysis. The results are compared with those of other workers (*e.g.*, Warren *et al.*, A., 1936, 1054) and possible interpretations are discussed. It is claimed that neither the " network " nor the " crystallite " hypothesis is adequate, and that in the K_2O–SiO_2 glasses there are two independent structures present, viz., that of the SiO_2 glass almost unchanged and that of the K_2O-containing constituent. F. J. G.

X-Ray investigation of the system Ni–P. H. Nowotny and E. Henglein (Z. physikal. Chem., 1938, **40**, **B**, 281—284).—On the Ni-rich side the phases Ni_3P, Ni_5P_2, and Ni_2P are indicated. A phase of the composition Ni_7P_3 also occurs and this appears to have a body-centred cubic lattice structure. Ni_3P and Ni_2P are analogous to the corresponding phases in the systems Fe–P and Mn–P, and belong to the space-groups $I\bar{4}$ and $C32$, respectively. T. H. G.

X-Ray investigation in the systems Mn–Bi, Co–Sb, and Ni–Sb. U. Fürst and F. Halla (Z. physikal. Chem., 1938, **40**, **B**, 285—307).—A criterion of stability published previously (A., 1937, 1, 509) is developed. In the Mn–Bi system the *X*-phase is orthorhombic with *a* 4·30, *b* 5·24, *c* 6·30 A. but it is uncertain whether it is Mn_2Bi. The *Y*-phase has a tetragonal cell with *a* 5·83 and *c* 5·35 A. and should be formulated as Mn_2Bi. The phase CoSb in the system Co–Sb has the structure of NiAs with *a* 3·866 and *c* 5·183 A. The $CoSb_2$ phase has a marcasite structure with *a* 3·20, *b* 5·78, and *c* 6·41 A. In the system Ni–Sb the γ-phase is shown to have a NiAs structure. For the β-phase a tetragonal cell with dimensions *a* 5·78 and *c* 6·00 A. is indicated. Further work is necessary to decide whether this is a single phase of formula Ni_2Sb or Ni_5Sb_2. The cubic δ-phase is an interstitial solution of Ni in Ni_3Sb and has the composition $Ni_{13}Sb_4$. The ε-phase has a marcasite structure, the orthorhombic cell having *a* 3·20, *b* 5·63, *c* 6·22 A. The interat. distances have been determined and are discussed with reference to the type of binding. T. H. G.

X-Ray analysis of the system arsenic–antimony. W. Trzebiatowski and E. Bryjak (Z. anorg. Chem., 1938, **238**, 255—267).—The existence of a continuous series of mixed crystals at higher temp. is confirmed (cf. A., 1928, 1094), but with >25 at.-% As there is a change to a new phase on tempering. This β-phase is face-centred cubic, *a* 11·06—11·12 A., and the transition point lies between 400° and 550°. Certain allemontites have a two-phase mixed-crystal structure which is not in equilibrium in the temp. range studied. F. J. G.

X-Ray spectrum and structure of copper and nickel in certain copper–nickel alloys. J. Farineau and M. Morand (Compt. rend., 1938, **206**, 1895—1896).—The Cu $L\alpha$ line given by alloys containing 25 and 40% Ni is not measurably narrower than the $L\alpha$ line of pure Cu. The Ni $L\alpha$ line given by these alloys is, however, ~1 and 0·4 e.v. narrower than the line for pure Ni; this indicates a diminution in the width of the energy band of the 3*d* level in Ni owing to the introduction of Cu atoms into the lattice. A similar effect is observed for Cu in Cu–Zn alloys. A. J. E. W.

X-Ray investigation of cobalt–tin alloys and a comparison of the system Co–Sn with Fe–Sn and Ni–Sn. O. Nial (Z. anorg. Chem., 1938, **238**, 287—296).—α-Co dissolves very little Sn, but at 1000° β-Co dissolves approx. 2·5 at.-%. There are four intermediate phases, two of which, γ' and γ, have the same composition, viz., 41—42 at.-% Sn. γ' is of the NiAs type with *a* 4·096—4·116, *c* 5·161—5·177 A., and contains excess of Co atoms irregularly distributed. Below 550° these take up an ordered arrangement and the γ-phase is formed; this is a superlattice based on a cell of NiAs type with *a* 4·089 and *c* 5·198 A. The other two phases are CoSn and $CoSn_2$; the former is hexagonal, *a* 5·268, *c* 4·249 A., and the unit cell contains 3 mols. and the space-group is D^1_{6h}. The latter is tetragonal, *a* 6·348, *c* 5·441 A.; the unit cell contains 4 mols. and the space-group is D^{18}_{4h}. Structure and equilibrium diagrams are given. F. J. G.

X-Ray investigation of cobalt–tungsten alloys. A. Magneli and A. Westgren (Z. anorg. Chem., 1938, **238**, 268—272).—The existence of two intermediate phases (cf. Sykes, Trans. Amer. Soc. Met., 1937, **25**, 953) is confirmed, but their compositions are Co_3W and Co_7W_6, and not Co_7W_2 and CoW. The former is hexagonal close-packed, *a* 5·120, *c* 4·120 A.; the latter is rhombohedral, *a* 8·92 or 8·99 A., α 30° 42′ or 30° 40′, according as it is saturated with Co or with W; the structure is the same as that of Fe_7W_6 (A., 1936, 926). There are indications of other phases in the region rich in Co. F. J. G.

Crystal structure of cadmium–indium alloys rich in indium. W. Betteridge (Proc. Physical Soc., 1938, **50**, 519—524).—The solubility of Cd in In, determined by *X*-ray diffraction, is 14·5±0·5 at.-% at 100° and 4·5±0·5 at.-% at 20°. The axial ratio of the face-centred tetragonal lattice of the In-rich solid solution decreases with increasing Cd content, until at 4·5 at.-% the structure becomes face-centred cubic. No change in the vol. of the In atom is associated with the change in axial ratio. N. M. B.

Phases CoTe–$CoTe_2$ and NiTe–$NiTe_2$. S. Tengnér (Naturwiss., 1938, **26**, 429).—The range of homogeneity of the phase of NiAs type in Co–Te and Ni–Te systems is very wide. CoTe and NiTe pass continuously into $CoTe_2$ and $NiTe_2$, respectively, as [Te] is increased. There is a gradual diminution in the vol. of the unit cell of the CoTe and NiTe phases as [Te] increases. The mineral melonite has a variable formula. A. J. M.

Structure of chromium–molybdenum alloys. W. Trzebiatowski and H. Ploszek (Natuurwiss., 1938, **26**, 462).—A systematic *X*-ray analysis of the Cr–Mo system has been carried out. The m.p. of the series of alloys shows a min. at 15 at.-% Mo at 1700°. A continuous range of mixed crystals is formed. The lattice const. varies approx. linearly with at. composition. This single-phase structure is also confirmed micrographically, but

does not agree with earlier results of thermal analysis which indicate a eutectic at 1460°. A. J. M.

Atomic rearrangement process in the copper–gold alloy Cu_3Au. II. F. W. JONES and C. SYKES (Proc. Roy. Soc., 1938, **A**, **166**, 376—390; cf. A., 1937, I, 74).—The size of the antiphase nuclei which form during the ordering of the alloy is measured by the breadth of the superlattice lines on *X*-ray powder photographs. The results are compared with electrical resistivity data for the alloy in the same condition. It is concluded that the antiphase nuclei are separated by narrow boundaries, 7·5 A. wide, of disordered alloy. The reflexion coeff. of a single boundary is deduced and is found to be the same for cold-worked and for annealed metal, although the rate of growth of the nuclei is greater in the annealed condition. G. D. P.

Superlattice formation of the type *AB* in alloys. T. S. CHANG (Proc. Camb. Phil. Soc., 1938, **34**, 224—237).—Mathematical. The process of ordering near the crit. temp. for alloys with a superlattice of the type *AB* is considered and discussed in relation to the adsorption of gases on a solid surface. F. J. L.

Atomic vibrations of a Zn–Cu alloy. R. A. HOWARD (Physical Rev., 1938, [ii], **53**, 966—971).—Measurements of *X*-ray reflexion intensities at two temp. for the $21\bar{3}1$ and $10\bar{1}5$ lines given by a Zn–Cu alloy confirm the view that the at. vibrations are greatest along the *c* axis when the axial ratio is >1·633 and least when it is <1·633, corresponding with a system of close-packed spheres and an abnormal separation of the atoms along the direction of the *c* axis. Relative at. structure factors show an unexpectedly sharp dependence on the angle which the normal and the reflecting plane makes with the *c* axis. N. M. B.

Constitution of the alloys of tin with bismuth. A. C. DAVIDSON (Tech. Publ. Internat. Tin Res. and Dev. Counc., 1938, **A**, No. 77, 3—14).—The equilibrium diagram for Sn–Bi alloys (0—100%) has been determined by thermal and metallographical analysis. A eutectic occurs at 57% Bi and 138·5°. The solid solubility of Bi in Sn at the eutectic temp. is 21·5%; that of Sn in Bi is 0·1—0·2%. E. S. H.

Formation of two liquid layers in copper–iron alloys. K. IWASÉ, M. OKAMOTO, and T. AMEMIYA (Sci. Rep. Tôhoku, 1938, **26**, 618—640).—The liquidus of these alloys and the equilibrium of liquid alloys at 1450° and 1540° have been examined. The liquidus curve of the pure Cu–Fe system indicates no monotectic reaction. The presence of 1% of Al, Ni, Pb, Sn, or Zn, in 50 : 49 Cu–Fe alloys did not cause separation of the liquid into two layers. In the C–Cu–Fe system two liquids coexist at 1450° and 1540°. Although in each case the heterogenous zone lies near the abscissa, it does not cut it. Thus in Cu–Fe alloys with <0·03% C up to ≮1540° no separation of the liquid into two layers occurs. At >0·03% separation occurs. The greater is the Fe content the more C is required to effect the separation. The temp. coeff. of mutual solubility of the conjugates is positive. C. M. A.

Solidification diagram of copper–aluminium alloys. W. BRONIEWSKI, S. JELNICKI, and M. SKWARA (Compt. rend., 1938, **207**, 233—235).—The equilibrium diagram is given. The compounds $AlCu_3$, $AlCu_2$, Al_2Cu_3, AlCu, and Al_2Cu are observed. $AlCu_2$, AlCu, and Al_2Cu undergo allotropic transformations. That of $AlCu_2$ at 870° leads to dissociation of $AlCu_3$. The transformation of AlCu at 621° results in the formation of a eutectic analogous to pearlite, at 570°. The transformation of Al_2Cu at 574° is accompanied by a vol. change. H. J. E.

Precipitation in supersaturated beryllium–nickel alloys followed microscopically. L. GRAF (Z. Metallk., 1938, **30**, 59—62).—The course of pptn. in single crystals and in polycryst. aggregates of 2·5% Be–Ni alloy is shown in a series of photomicrographs. In the polycryst. alloy pptn. begins along the grain boundaries and proceeds slowly into the grains, whilst in single crystals pptn. commences along polishing scratches or, if the crystal has been made by a casting process, at points of lattice distortion where the last of the eutectic was absorbed by the primary dendrites during homogenisation. A. R. P.

Structure of alloys of beryllium with silver, palladium, and gold. O. WINKLER (Z. Metallk., 1938, **30**, 162—173).—Two new phases have been discovered in the Be–Ag system by *X*-rays and thermal and magnetic analysis: δ, cubic face-centred $MgCu_2$ type, 24 atoms per unit cell, *a* 6·287 A., and γ, complex lattice of undetermined structure; δ contains 73 at.-% Be and is formed by a peritectic reaction at 1010° whilst γ is formed by decomp. of δ at 880° (<73 at.-% Be) or 850° (>73 at.% Be) and decomposes below 760° into Ag-rich and Be-rich solid solutions. Be dissolves <3 at.-% Ag and Ag 3·5 at.-% Be at the eutectic temp. (880°). Pd and Be form a eutectic at 930°, with 20 at.-% Be, and a compound PdBe, m.p. 1460°; four other compounds are formed by peritectic reactions, Pd_3Be at 960°, Pd_2Be at 1090°, Pd_2Be_3 at 1170°, and Pd_3Be_4 at 1200° whilst $Pd_{12}Be_{13}$ is formed by a reaction in the solid state at 1055°. Au and Be form a eutectic at 580°, 20 at.-% Be, the compounds Au_2Be and AuBe melting congruently at 645° and 730°, Au_3Be by a peritectic reaction at 595°, and Au_4Be_3 by a reaction in the solid state at 610°; Au_2Be and AuBe form a eutectic at 602°, 40 at.-% Be. AuBe exists in two modifications, α stable above 585° and β stable at lower temp., and Au_4Be_3 decomposes into Au_2Be and AuBe below 555°. Au dissolves <0·9 at.-% Be. A. R. P.

Thermal and *X*-ray studies of the titanium–iron system. H. WITTE and H. J. WALLBAUM (Z. Metallk., 1938, **30**, 100—102).—The compound Fe_3Ti does not exist. Fe_2Ti forms tabular crystals, *a* 4·77, *c* 7·79 A., *c*/*a* 1·633, 4 mols. per unit cell, m.p. 1530°; a eutectic is formed with Fe at 1305°, 13% Ti, and a second eutectic with a phase richer in Ti. Fe dissolves about 4% Ti at 1000° and about 7% at 1300°, but Fe_2Ti dissolves <1% of Fe and <1% of Ti. Co and Ti form the compound Co_2Ti with a $MgNi_2$ structure, *a* 4·72, *c* 15·37 A., *c*/2*a* 1·628. A. R. P.

System Mg–Cu–Al, especially the section $MgCu_2$–$MgAl_2$. F. LAVES and H. WITTE (Metall-

wirts., 1936, **15**, 15—22; Chem. Zentr., 1936, ii, 365—366).—$MgCu_2$ takes up $>35\%$ of $MgAl_2$ isomorphously, the lattice undergoing expansion. With $>35\%$ of $MgAl_2$, hexagonal phases having successively the $MgNi_2$ and $MgZn_2$ structures appear. The whole forms a complete mixed crystal series up to 60% of $MgAl_2$. Revised data are given for the neighbouring Al-rich region. The supposed compound $Mg_2Cu_3Al_2$ is in reality a mixed crystal. The *compounds* $Mg_2Cu_2Al_5$ and $Mg_3Cu_7Al_{10}$ are reported. $CuAl_2$ has no solvent power for Mg. H. J. E.

X-Ray study of the iron–nickel–aluminium ternary equilibrium diagram. A. J. Bradley and A. Taylor (Proc. Roy. Soc., 1938, **A**, **166**, 353—375).—The phases in equilibrium at low temp. are identified by *X*-ray powder photographs. For <50 at.-% Al only body- and face-centred cubic structures are present; the latter include superlattice structures related to Ni_3Fe or Ni_3Al, as well as disordered structures. The former include superlattices related to Fe_3Al and to FeAl or NiAl. The directions of the tie-lines in the two-phase fields and of the magnetic boundaries are indicated on the diagram. At $>50\%$ Al the diagram is very complex. G. D. P.

Magnetic susceptibility of gold–copper, gold–silver, silver–copper, and copper–nickel alloys. W. Broniewski, S. Franczak, and R. Witkowski (Ann. Physique, 1938, [xi], **10**, 5—19).—The variation of the susceptibility with composition is discussed in relation to the structure of the alloys. N. M. B.

Electrical conductivity and equilibrium diagram of binary alloys. XXIII. System nickel–molybdenum. G. Grube and H. Schlecht (Z. Elektrochem., 1938, **44**, 413—422).—Temp.–resistivity curves for Ni–Mo alloys are given. The curves for alloys with 22—55% Mo show a max. at 800—900°; this is most marked with 30% Mo, and indicates the appearance of a new phase (β) below 900°. *X*-Ray photographs confirm the existence of this phase and show that it has a face-centred tetragonal superlattice. For the alloy with 30% Mo $a=3{\cdot}61$, $c=3{\cdot}56$ A. This phase is homogeneous from 18 to 31% Mo at room temp. It may be regarded as the *compound* Ni_4Mo with its components in solid solution. The above conclusions are supported by photomicrographs and by measurements of hardness and of rate of corrosion. F. J. G.

Magnetic susceptibility and equilibrium diagram of binary alloys. III. System nickel–molybdenum. G. Grube and O. Winkler (Z. Elektrochem., 1938, **44**, 423—428).—χ–T curves for Ni–Mo alloys in the paramagnetic region are given. These confirm the existence of the β-phase (cf. preceding abstract) below 875° and also indicate the formation, below 925°, of the *compound* Ni_3Mo. This is hexagonal close-packed with a 2·54 A. and c/a 1·65. A complete equilibrium diagram is given. F. J. G.

Thermodynamic interpretation of the mechanism of the austenite–martensite transformation. C. H. Johansson (Arch. Eisenhüttenw., 1937—8, **11**, 241—251).—The dependence on the temp. and C content of the free energy of γ- and α-Fe has been calculated from the heat content, entropy, and free energy of α- and γ-Fe between 300° and 1800° K., and the position of the C atoms in the lattice in the various states is discussed. In the neighbourhood of the eutectoid point the change in the free energy of the α and γ states with composition (c) can be expressed by an equation from which it is possible to forecast the course of the austenite decomp. There is a crit. composition, c_k, such that when $c < c_k$ the temp. at which pptn. takes places without retardation by metastable states is the lower the higher is the C content, and when $c > c_k$ there is a crit. temp. of pptn. which is independent of the composition. It is also shown that the temp. of the austenite–martensite transformation must decrease with increasing C content. On annealing tetragonal martensite in the temp. range in which at. diffusion occurs or on quenching austenite to this range a transitional state is produced in which the whole of the C content is held in the α-Fe lattice to form cubic martensite; the hardness of this phase is therefore attributable to distortions produced by the C atoms in the lattice. The blurred röntgenograms given by cubic martensite are due to variations in the composition produced by the partial decomp. of this phase which always accompanies its formation. A. R. P.

Atomic and ionic radii. II. Application to the theory of solid solubility in alloys. W. Hume-Rothery and G. V. Raynor. **III. Polarisation effects in alloys.** G. V. Raynor (Phil. Mag., 1938, [vii], **26**, 143—152, 152—165; cf. A., 1938, I, 431).—II. The solubility of Ag, Cd, In, Sn, and Sb in solid Cu, Ni, Co, and Fe is discussed. Cu has a full type structure and has therefore difficulty in accomodating the larger Ag ion in its lattice. The Cd ion, although $>$ Cu, is slightly $<$ the Ag ion and accordingly Cd is more sol. than Ag in Cu. With In, Sn, and Sb the ions are smaller and more easily introduced. The solid solubility increases with increasing temp. since the expansion of the metal makes it easier to accomodate the larger ions. The mutual solid solubilities of pairs of metals of the full type and the relative stabilities of superlattices of the types A_3B and AB_3 are considered and the solid solution in the metal of larger ionic diameter is the greater. When the two ionic radii are approx. equal the mutual solid solubilities depend on the densities and deformabilities of the electron clouds. The following systems illustrate these general principles: Cu–Ag, Cu–Au, Cu–Pd, Cu–Pt, Au–Ni, Au–Co, Au–Fe, Au–Mn, Au–Cr, Zn–Cd, Ag–Be.

III. For a pair of metals of the open type, where one is a powerfully deforming ion and the other is easily deformable, the more powerfully polarising ion should give rise to the wider range of solid solutions. This prediction is fulfilled by alloys of metals of the *A* sub-groups. With metals of the *B* sub-groups the sizes of the ions are more important because these metals are usually of a full type structure and it is difficult to assess their polarising powers. In binary alloys it appears that in general, and more particularly for metals of *B* sub-groups, the less compressible metal will dissolve a greater quantity of the more compressible than vice versa. W. R. A.

Defect lattices and catalytic activity. A. TAYLOR and J. WEISS (Nature, 1938, **141**, 1055).—Al is dissolved from the alloy Ni_2Al_3 by treatment with NaOH. The composition (59·2% Ni) changes to approx. 80% Ni without loss of the trigonal symmetry. The NaOH removes Al atoms from the lattice leaving vacant sites, but when only approx. 0·5% of Al is left, the structure collapses and tends to form the face-centred cubic structure of Ni. No intermediate body-centred structure appears to be formed in the process. Most of the material consists of relatively large particles ~1000 A. Electron transfer processes are probably much enhanced in certain Ni structures with defective lattices which possess a highly unsaturated surface, and this may explain the activity of such substances as catalysts in hydrogenation. L. S. T.

Solubility curves of the systems carbon tetrachloride–branched-chain alkyl acids–water at 25°. H. A. SMITH and H. TAYLOR (J. Amer. Chem. Soc., 1938, **60**, 1696—1697).—Data are recorded for systems containing $Pr^{\beta}CO_2H$, $Bu^{\beta}CO_2H$, $CHMeEt{\cdot}CO_2H$, and $Bu^{\gamma}CO_2H$. The curves show that the mutual solubility area decreases with increased chain branching. E. S. H.

Complete phase diagrams for pressure, temperature, and composition of binary systems with vapour pressure maxima in the liquid mixtures. E. JÄNECKE (Z. physikal. Chem., 1938, **182**, 177—185).—A theoretical investigation. T. H. G.

Solubility of silver chloride in aqueous solutions of silver nitrate. A. PINKUS, (MLLE.) S. FREDERIC, and R. SCHEPMANS (Bull. Soc. chim. Belg., 1938, **47**, 304—336).—The solubility (*s*) of fine colloidal dispersions of AgCl in aq. $AgNO_3$ (5×10^{-5}—2M) has been determined at 25° by the opalescence method. *s* decreases with $[AgNO_3]$, passes through a min. for 0·003M-$AgNO_3$, and then increases. The effect is attributed to adsorption of $Ag^{\cdot}$ on the AgCl particles, modifying their thermodynamic potential and hence their solubility product. The results can be explained by supposing that AgCl dissolves in aq. $AgNO_3$ as the complex $[Ag_{m+n}Cl_m](NO_3)_n$ (possibly $[Ag_3Cl_2]NO_3$ or $[Ag_2Cl]NO_3$) and as peptised colloidal micelles, as well as in the form of $Ag^{\cdot}$ and Cl' ions. J. W. S.

Solubility of silver chloride in aqeous solutions of nitric acid. A. PINKUS and R. SCHEPMANS (Bull. Soc. chim. Belg., 1938, **47**, 337—360).—The solubility (*s*) of AgCl in $1{\cdot}3 \times 10^{-5}$—9·0M-HNO_3 has been determined at 25° by the opalescence method. *s* increases at a diminishing rate with rise of $[HNO_3]$, tending to a limiting val. of $2{\cdot}75 \times 10^{-5}$ g.-mol. per l. This is > double the val. found for *s* in pure H_2O ($1{\cdot}277 \times 10^{-5}$ g.-mol. per l.). The solubility product of AgCl at 25° is $1{\cdot}621 \times 10^{-10}$, and its activity coeff. in saturated aq. solution is 0·996. J. W. S.

Stability of intermetallic compounds in the molten state. E. HEYMANN and H. P. WEBER (Nature, 1938, **141**, 1059).—The partition of Na between molten NaBr and molten Pb at 770° shows the existence of strong interat. forces in the metal phase. When Pb is replaced by molten Bi the heavy metal is insol. in molten NaBr, but dissolves when alloyed with Na. A Na–Sb or Na–Sn alloy behaves similarly when used as the liquid metal phase. Tl, Cd, and Pb, although they form intermetallic compounds with Na, do not pass into the salt phase when alloyed with Na. These results suggest that compounds of Na with heavy metals are stable at temp. approx. 200° above the respective m.p., but decompose at higher temp. L. S. T.

Adsorption phenomena. A. BOUTARIC (J. Chim. phys., 1938, **35**, 158—178; cf. A., 1938, I, 76).—A theoretical discussion of the adsorption of one or more constituents in solution or gaseous form. E. S. H.

Adsorption of gaseous mixtures at solid surfaces. F. J. WILKINS (Nature, 1938, **141**, 1054—1055).—An extension of previous work to gaseous mixtures (cf. A., 1938, I, 306). L. S. T.

Adsorption isotherms and heats of adsorption of helium gas on charcoal between 20° K. and 6° K. New desorption experiments. A. VAN ITTERBEEK and W. VAN DINGENEN (Physica, 1938, **5**, 529—540).—The adsorption isotherms for 0·1—70 cm. have been obtained. They are represented by the formula $\log(X/P) = A + BX$, *X* being the quantity of He adsorbed; $A = a_0 + a_1/T$ and $B = b_0 + b_1/T$ (a_0, a_1, b_0, b_1 being consts.), in agreement with Williams' theory. Heats of adsorption have been calc. and tests on the attainment of low temp. by desorption of He and H_2 from charcoal are described. It is inferred that the crit. point of H_2 can be reached by the desorption method, using H_2 as the adsorbed gas. A. J. E. W.

Chemisorption on charcoal. XI. Electrokinetic properties of activated charcoal. H. L. BENNISTER and A. KING (J.C.S., 1938, 991—997; cf. A., 1937, I, 561).—Standard technique for obtaining reproducible measurements of the electrophoretic velocity of C particles in suspensions in H_2O has been developed. With rising activation temp. betwen 380° and 850° there is a gradual increase in electrophoretic velocity; a max. is reached at 800—850°, and at higher temp. (up to 1030°) the velocity falls. There is a general relation between electrophoretic velocity and adsorptive capacity. No evidence of positively-charged C particles was obtained. The electrophoretic velocity–concn. curve passes through a min. at medium concns. E. S. H.

Adsorption of vapours at plane surfaces of mica. II. Heats of adsorption and the structure of multimolecular films. D. H. BANGHAM and S. MOSALLAM (Proc. Roy. Soc., 1938, **A**, **166**, 558—571; cf. A., 1938, I, 354).—Measurements are made of the quantities of C_6H_6, MeOH, and CCl_4 adsorbed on a known surface of mica at pressures approaching saturation. The adsorption energy per mol. is const. during the formation of the first layer of mols., but when this is complete the energy decreases abruptly to a val. near the normal heat of liquefaction. Discontinuities in the isotherms are thought to be related to intermol. spacings in the condensed phases. Vals. are given for the decrease of surface tension of mica due to the saturated vapours. G. D. P.

Adsorbability of chain molecules. A. BAUM and E. BRODA (Trans. Faraday Soc., 1938, **34**, 797—799; cf. A., 1938, I, 26).—The adsorption of different fractions of paraffin wax on C from 0·3% C_6H_6 solution at 25° increases with the mean mol. wt. No such regularity was observed in the adsorption on C or Al_2O_3 of fully acetylated glucose, cellobiose, or cellulose, owing to the lack of attainment of equilibrium even after several months. Hence in practice (*e.g.*, in chromatographic analysis) the determining factor may be diffusion velocity rather than chain length. F. L. U.

Sorption of vapours of various liquids by cellulose and its derivatives. K. KANAMARU and J. CHAO (Kolloid-Z., 1938, **84**, 85—99).—Isotherms for the sorption of MeOH, EtOH, $Pr^{\alpha}OH$, $Bu^{\alpha}OH$, Et_2O, $COMe_2$, C_6H_6, AcOH, and $CHCl_3$ by different preps. of cellulose, "viscose," cellulose acetate and nitrate have been determined. Cellulose hydrate has less adsorbent power for the vapours than has ordinary cellulose, although it is more hygroscopic. The adsorbent power of the derivatives in the form of film is < for the powder or fibrous form at low v.p., but > for the powder at high v.p. The adsorption power is not symbatic with the solubility of the derivatives. The relation between ζ-potential and lyophilic properties is discussed. E. S. H.

Adsorption of colloidal graphite by metallic surfaces. M. AUBRY (J. Chim. phys., 1938, **35**, 152—157).—The adsorption of aq. graphite sols by Pb pellets and Fe filings has been determined by measuring the opacity of the sols before and after adsorption. The influence of duration of contact and concn. of sol at const. temp. has been examined. Saturation is reached when the thickness of the adsorbed layer attains 13·5 A. *X*-Ray examination shows that the adsorbed graphite is oriented on the hexagonal basal plane. E. S. H.

Adsorption potentials. S. R. CRAXFORD, O. GATTY, and (LORD) ROTHSCHILD (Nature, 1938, **141**, 1098—1099).—A discussion of the theory of adsorption potentials and of the results of Ehrensvärd and Sillén (A., 1938, I, 354). The early stages of a diffusion gradient in oil–H_2O interphases may confine diffusion to the first one or two mol. layers of the oil phase. L. S. T.

Statistical theory of adsorption with long-range interaction. J. S. WANG (Proc. Camb. Phil. Soc., 1938, **34**, 238—252).—The statistical theory of long-range interactions between adsorbed particles on a plane lattice is worked out approx., and general formulæ for the adsorption isotherm and the heat of adsorption are obtained. F. J. L.

Chemical specificity of different active states of one and the same substance. R. FRICKE, F. BLASCHKE, and C. SCHMITT (Naturwiss., 1938, **26**, 429—430).—The ratio of the adsorption of $K^{\cdot}$ to that of PO_4''' from solutions of K_3PO_4 on various active forms of α-Fe_2O_3 has been determined. The active forms were obtained by dehydration of α-FeO_2H (goethite) at 240—600°, and show selective adsorption, the molar ratio of adsorption of $K^{\cdot}$ to that of PO_4''' being 2·06 for α-FeO_2H, 2·21 for the most active, and 0·55 for the least active, form of α-Fe_2O_3. A. J. M.

Stabilising effect of adsorption layers and their mechanical properties. A. A. TRAPEZNIKOV and P. A. REHBINDER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 427—430).—Cholesterol (I) reduces the two-dimensional v.p. of films of oleic and myristic acids and Et palmitate and brings the films to the condensed state. The stabilising effect decreases with increasing concn. of (I). The stability of foam bubbles is not exclusively determined by the mechanical properties of the adsorption layer. The collapse of the two-sided film surrounding a foam bubble is attributed to the formation of dehydrated aggregates for which the rate of reverse propagation into the film is < the velocity of destruction of the bubble. The stabilising effect of films formed by homologous compounds may be compared only for films in similar states. H. J. E.

Surface tension at the interface between two non-miscible liquids. VI. C. BELCOT (Ber., 1938, **71**, [*B*], 967—973; cf. A., 1938, I, 135).—Approx. the same drop no., indicating the same diminution of the surface tension (γ), is observed in alkaline solutions of NH_3, $NHEt_2$, and NaOH of the same ionic concn. (between $v/\gamma = 50$ and $v/\gamma = 1000$) but widely differing total dilution, v. In alkaline solution of the same total concn. the drop nos. are widely different. The most marked effect on γ is exerted by stearic acid (I), followed by palmitic and oleic acid; this depends on the colloidal nature of their salts, the mol. orientation at the interface, and the solubility in H_2O. The cation of the base has no influence on γ. The depression of γ is caused by the neutralisation of the fatty acid in the org. liquid by the base in the aq. phase at the interface, whereby a capillary-active salt is formed. The process is a function of $[OH^-]$ which controls the amount of salt produced. The lowering of γ is a function of the concn. of the fatty acid; it passes through a min. which is most pronounced with (I) since the solubility of its salts and thus the production of colloidal micelles is less, thus corresponding with a max. of γ. The diminution of γ depends on the org. solvent for the fatty acid; the magnitude of the effect diminishes in the sequence C_6H_6, PhMe, CS_2, $CHCl_3$. A pronounced effect on the diminution of γ is not caused by CO_2; the curve has the same form as the titration graph. NaCl (or NH_4Cl) introduced into the aq. phase still further diminishes γ since it has a pptg. action on the soap produced, *i.e.*, it increases the concn. of the mols. at the surface of the org. solvent. It thus appears possible to determine traces of salts in dil. alkaline solutions by a method analogous to that for the determination of naphthenic acids in fractions of petroleum. An explanation of the anomalies observed with solutions of NH_3 is presented. H. W.

Influence of temperature on the interfacial tension in the system castor oil-water. J. J. TRILLAT and P. NARDIN (Compt. rend., 1938, **207**, 291—293).—Below 45° the tension in a fresh interface diminishes rapidly with time during the first 6—12 hr., and the extent of the decrease rises with

falling temp. The effect is attributed to progressive orientation of the ricinoleic ester mols. in the surface, this orientation being hindered by thermal motion at higher temp. A. J. E. W.

Effect of electrolytes on the surface tension of saponin solutions. (MLLE.) P. BERTHIER (Compt. rend., 1938, **206**, 1760—1762).—Saponin (0·05%) lowers the surface tension of 0·5N aq. solutions of many electrolytes to a greater extent than pure H_2O. The effect of chlorides depends on the valency of the cation; the higher is the valency, the greater is the decrease in surface tension for solutions with equal nos. of ions. Th^{++++} has the opposite effect. With KOH the lowering is > with K salts. The effects produced by $AlCl_3$ and $FeCl_3$ are due to partial hydrolysis. J. L. D.

Motion of a mercury index in a capillary tube. G. D. YARNOLD (Proc. Physical Soc., 1938, **50**, 540—552).—Variation of the velocity of movement with the applied pressure difference leads to a val. of η which is 6% > the accepted figure for Hg. The discrepancy is attributed to electrification of the wall of the capillary tube. N. M. B.

Theory of electrosmotic circulation in varying fields. P. WHITE (Phil. Mag., 1938, [vii], **26**, 49—65).—The electrosmotic motion set up in a liquid by an a.c. field is examined theoretically for open and closed laminar and cylindrical cells. W. R. A.

Spreading of aliphatic hydrocarbons on solid surfaces. R. HERZOG (Monatsh., 1938, **72**, 42—51).—The spreading of long-chain aliphatic hydrocarbons and acids on Au and cellulose surfaces has been studied by electron diffraction. Films giving the characteristic " fat-rings " are formed by evaporation of C_6H_6 solutions of the compounds on the surface, by diffusion of paraffin or of lauric acid–stearic acid, oleic acid–stearic acid, or lauric acid–oleic acid mixtures over the surface at temp. below the m.p., and in the case of paraffin only by condensation of the vapour on the surface. O. D. S.

Theory of the viscosity of unimolecular films. W. J. MOORE, jun., and H. EYRING (J. Chem. Physics, 1938, **6**, 391—394).—The equation for the fluidity of a liquid, based on the reaction rate theory of viscous flow, has been modified. Using recorded data for viscous flow in surface films the free energy of activation for viscous flow is approx. twice that for flow of the liquid in bulk. This suggests some kind of association of mols. in the film, *e.g.*, lateral association to dimerides, trimerides, etc., or vertical association (solvation). Equations are given for the pressure and temp. effects on surface viscosity. Knowledge of these effects is helpful in interpreting the structure of the films and the contribution to the free energy of activation due to lateral association, solvation, and H bonding. W. R. A.

Electrical conductivity of thin metallic films. III. Alkali films with the properties of the normal metal. A. C. B. LOVELL (Proc. Roy. Soc., 1938, **A**, **166**, 270—277; cf. A., 1937, I, 121, 229).—The method previously employed has been modified and applied to the investigation of a greater range of film thicknesses. Films of Cs 10^4 A. thick have resistivities 4% > that of the bulk metal; Rb and K films of this thickness have higher resistivities but the same temp. coeff. as the metals in bulk. It is inferred that thin films do not differ essentially in structure from the normal metal. G. D. P.

Superconducting thin films. A. SHALNIKOV (Nature, 1938, **142**, 74).—Films of Pb and Sn, 5×10^{-7} to 2×10^{-5} cm. thick, condensed from the vapour on to glass at 4·2° K., show anomalous superconductivity. The transition temp. are higher than for the bulk metals (for Sn by approx. 1° K.), whilst the currents required to restore resistance are < those predicted by Silsbee's hypothesis, and the magnetic fields required to restore resistance are ≫ for the bulk metal. These anomalies are modified when, after deposition, the films are warmed to room temp. and then re-cooled. The transition temp. for Sn drops to the normal val. for bulk Sn. Structure of the films is partly responsible for the above anomalies. L. S. T.

Macroscopic representation of unimolecular layers and their behaviour under different states of compression. H. DEVAUX and L. PALLU (Compt. rend., 1938, **206**, 1693—1695).—The conditions obtaining in a unimol. layer are reproduced on a macro scale by a layer of colza seeds on a Hg surface. The existence of the two crit. points is readily demonstrated. A. J. E. W.

Overturning and anchoring of monolayers. I. LANGMUIR (Science, 1938, **87**, 493—500).—The structure and surface properties of monolayers and multilayers are frequently determined by the orientations of individual mol. layers, but under certain conditions a layer may experience an almost instantaneous reversal of orientation. This reversal may change the chemical and physical properties. L. S. T.

Polish on metals. W. COCHRANE (Proc. Roy. Soc., 1938, **A**, **166**, 228—238).—Electron diffraction patterns are obtained for thin films of Au and Cr electrodeposited on Ni and Cu bases. The films are stripped from the bases and examined by transmission after polishing The Au film gives a pattern of three diffuse rings, from which it is inferred that it consists of very small crystal grains and that the polish layer resembles a monat. liquid. After 15 hr. at room temp. the Au film gave a pattern of sharp rings, showing that crystal growth had taken place. G. D. P.

Measurements of resistance and capacity of monofilms of barium stearate. C. E. BUCHWALD, D. M. GALLAGHER, C. P. HASKINS, E. M. THATCHER, and P. A. ZAHL (Proc. Nat. Acad. Sci., 1938, **24**, 204—208).—Apparatus and procedure are described and preliminary results reported. E. S. H.

Potentials of built-up multilayers on metals. J. J. BIKERMAN (Trans. Faraday Soc., 1938, **34**, 800—803).—Phase boundary potentials of multilayers of Ba stearate, deposited on Cr by a process which is described, are < those of natural X films, are independent of the no. of monolayers present, and increase by about 0·2 v. when kept in air for 16 hr. Multilayers of Ca stearate on Cr in H_2O give

potentials which do not vary with p_H in the range 8·2—9·8. F. L. U.

Structure of built-up films on metals. (A) I. FANKUCHEN. (B) J. J. BIKERMAN and J. H. SCHULMAN (Physical Rev., 1938, [ii], **53**, 909).—(A) Measurements with a condensing monochromator, using Cu $K\alpha$ radiation, show that the spacings in the X and Y types of Ba and Ca stearate films are identical (cf. Holley, A., 1938, I, 300).

(B) An explanation of the identity found above is proposed on the basis that the X films change their electric properties when irradiated by X-rays and that the direction of the change corresponds with the transformation of X into Y films. A new technique for preparing the stearate films is described. N. M. B.

Contact potential of solid films formed by evaporation and by solidification and of built-up multilayers on metals. W. D. HARKINS and R. W. MATTOON (Physical Rev., 1938, [ii], **53**, 911—912).—The contact potential between two plates of pure Au changes rapidly with each X layer of Ca stearate which is deposited on one of them. Several potential anomalies of X and Y type stearates deposited on metals are described and provisionally explained. N. M. B.

Built-up films of steroid compounds. H. SOBOTKA and (MISS) E. BLOCH (J. Biol. Chem., 1938, **124**, 559—566).—The properties of unimol. built-up layers of cholanic acid are described and compared with those of related substances. C. R. H.

Optical and X-ray examination and direct measurement of built-up protein films. W. T. ASTBURY, F. O. BELL, E. GORTER, and J. VAN ORMONDT (Nature, 1938, **142**, 33—34).—Films characterised by as many as 1764 monolayers have been built up from recryst. egg-albumin by successive vertical movements of a Cr-plated slide through a monolayer spread on a liquid substrate (A., 1937, I, 180). Such films can be stripped from their metal base. Optical examination showed the stripped films to be birefringent, with the fastest vibration lying in the plane of the film, and the intermediate vibration perpendicular to the film. X-Ray photographs correspond with polypeptide chains lying approx. parallel to the direction of movement of the slide, with their side-chains approx. perpendicular to the plane of the film. The cohesive forces evoked by drying appear to bring about aggregation at the expense of orientation. It is inferred that the chains pre-exist on the surface of the substrate. Direct measurement of the thickness of the films gives a thickness of approx. 9·5 A. and not 20 A. (*loc. cit.*) per monolayer. L. S. T.

Evaporation of concentrated films of sodium. R. C. L. BOSWORTH (Proc. Camb. Phil. Soc., 1938, **34**, 262—271; cf. A., 1937, I, 599).—The evaporation of multimol. films of Na (1 to 20 layers) is studied by the method of contact potentials. The v.p. and the heat of evaporation increase as the thickness increases up to three layers and then remain practically const. F. J. L.

New methods for studying metallic diffusion. P. CHEVENARD and A. PORTEVIN (Compt. rend., 1938, **207**, 71—73).—Direct and indirect methods are reviewed. A thermomagnetic method has been used to study the diffusion in a multi-laminar Fe-Ni specimen formed by welding alternately layers of two alloys containing 33% and 73% Ni and subsequently reducing the thickness of the specimen to 14 μ. by cold-rolling. W. R. A.

Different structures of the aqueous vapour deposited by sulphur on certain aliphatic substances. R. MÉRIGOUX (Compt. rend., 1938, **207**, 47—48).—The aq. vapour from S was allowed to condense on drops of paraffin oil and of oleic acid and the discontinuous films were examined microscopically. Photomicrographs showing the different structures are reproduced. The nature of the film is very sensitive to the nature of the substrate, and it is claimed that the presence of small amounts of impurities in a substrate can be detected by the method. W. R. A.

Mechanical properties of films and the stability of foams. P. A. REHBINDER and A. A. TRAPEZNIKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 423—426).—A method is described for measuring the η in two-sided aq. solution films formed between two concentric horizontal Pt rings, the outer of which (6·12 cm. diameter) was fixed, while the inner one (5·39 cm.), suspended on a W torsion wire, was caused to oscillate in the plane of the film, and the damping measured. The log decrement of oscillations is approx. $\propto \eta$. Data for aq. Na oleate (I) films [0·03—1·05% of (I)] are recorded. The effect of ageing was studied. The data are correlated with observations on the stability of foams prepared from the same solutions of (I). The vol. of foam formed increases with the concn. of (I) to a const. max. at approx. 0·1%. H. J. E.

Optical properties of stratified cholesteric substances. J. P. MATHIEU (Compt. rend., 1938, **206**, 1890—1891).—The character and state of polarisation of the transmitted and diffused light in films of cholesteryl propionate or cinnamate are described. A. J. E. W.

Soap bubbles. F. B. WADE (J. Chem. Educ., 1938, **15**, 290; cf. A., 1938, I, 355).—An aq. solution of "Dreft" can be used with "raw" H_2 to obtain satisfactory bubbles. L. S. T.

Precision pyknometry for solids, liquids, and solutions. Density of sodium and potassium chloride solutions at 0°. Apparent molecular volumes of these electrolytes in solution. T. BATUECAS (Z. physikal. Chem., 1938, **182**, 167—176).—The apparent mol. vols. (ϕ_0) of NaCl and KCl have been found to be $\propto$ (concn.)$^{\frac{1}{2}}$ over the range 0·2 to 0·5N. Below 0·2N this relation does not hold. By extrapolation to infinite dilution ϕ_0 at 0° is found to be $12{\cdot}70_4 \pm 0{\cdot}003$ c.c. for NaCl and $23{\cdot}71_3 \pm 0{\cdot}006$ c.c. for KCl. T. H. G.

Absorption of ultrasonic waves in electrolytes. P. BASHULIN (Conipt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 153—156; cf. A., 1937, I, 230).—Data for solutions of some of the commoner chlorides, nitrates, and sulphates using a frequency 30,500 kHz. at room temp. are recorded. Data showing the dependence

of the coeff. of absorption, α, on concn. and frequency for solutions of $MgSO_4$ are also given. The val. of $\Delta\alpha/\nu^2$, where $\Delta\alpha$ is the difference between the vals. of α for the electrolyte and for H_2O, is approx. $\propto$ concn. For uni-univalent salts the val. of α/ν^2 does not deviate markedly from that of pure H_2O ($\alpha/\nu^2 = 28 \times 10^{-17}$). α increases with an increase in the mol. wt. of the cation and in its valency. L. S. T.

Diffusion of *X*-rays through very small angles applied to the study of fine particles and colloidal suspensions. A. GUINIER (Compt. rend., 1938, **206**, 1374—1376).—The diffusion of *X*-rays through small angles by solids and liquids has been investigated, using a narrow monochromatic *X*-ray beam (A., 1937, I, 378). In general the intensity of the diffused radiation decreases to a min. for small angles of diffusion, but when the diffusing medium contains small particles the diffusion increases rapidly for angles < 4—$5°$, with a max. in the direction of the beam. A relation is given from which the mean size of the particles and the mean no. of atoms in each particle may be derived from microphotometric observations of the photographic image of the diffused beam. With *X*-rays of λ 1·5 A. particles of 10—100 A. diameter, in the solid state or in colloidal suspension, may be studied and with smaller $\lambda\lambda$ the method may be applied to ions and mols. A. J. E. W.

Adherence of particles of microscopic size. IX. Influence of fatty acids on the adherence of quartz particles in aqueous solutions. A. VON BUZÁGH and I. ZIMMERMANN (Kolloid-Z., 1938, **84**, 16—24; cf. A., 1938, I, 358).—With increasing concn. of fatty acid the adherence of negatively-charged quartz particles increases at first, falls to a min., and then rises again. For the four simplest fatty acids the curve connecting adherence with concn. is displaced in the direction of decreasing concn. and the difference between the max. and min. increases with increasing mol. wt. Electrophoretic measurements show that at low concns. the adherence is related to the discharging effect of $H^{\cdot}$; at medium concns. the adherence diminishes as a result of the growth in thickness of the solvate sheath, due to adsorption of fatty acid mols.; the subsequent rise in adherence at high concns. is due to increasing dehydration of the solvate sheath. The influence of substitution and isomerism in the acids has been examined. With increasing concn. of fatty acid the adherence of positively-charged quartz particles decreases rapidly to a min., and then rises to a const. val.; the min. and the final vals. diminish with increase in the mol. wt. Electrophoretic measurements show that reversal of charge occurs in presence of low concns. of acid. E. S. H.

Detection of molecular aggregation by light scattering. R. S. KRISHNAN (Kolloid-Z., 1938, **84**, 8—15).—Technique for demonstrating the formation of mol. aggregates in liquid–liquid mixtures in the neighbourhood of the crit. solution temp. is described. The state of polarisation of light scattered at an angle of 90°, using horizontally polarised incident light, is measured. Data for the systems PhOH–H_2O, $PhNO_2$–*n*-C_6H_{14}, CS_2–MeOH, and NH_2Ph–*cyclo*hexane at different temp. are recorded. E. S. H.

Dispersion of depolarisation in light scattering in colloid systems. R. S. KRISHNAN (Kolloid-Z., 1938, **84**, 2—8).—The depolarisation of the Tyndall beam in colloid systems is characterised by the vals. ρ_u, ρ_v, and ρ_h, where ρ represents the ratio of the intensity of the weaker component of the polarisation to that of the stronger in light scattered at 90° angle, and *u*, *v*, and *h* refer respectively to unpolarised, vertically and horizontally polarised incident light. These vals. are related in accordance with $\rho_u = (1 + 1/\rho_h)/(1 + 1/\rho_v)$. The influence of shape and size of the particles is discussed. E. S. H.

Action of ionising radiations on colloidal graphite. J. A. CROWTHER, H. LIEBMANN, and R. JONES (Phil. Mag., 1938, [vii], **26**, 120—129).—Continuous irradiation of colloidal graphite with *X*-rays produces alternate increases and decreases in the potential of the particle. The max. change is about 12%. The change of ζ-potential depends on the dosage and is independent of its intensity; for a particular dosage, it is the same irrespective of whether the dosage is given in one amount or in two partial quantities separated by an interval of 24 hr. If the temp. of the sol is raised from 4° to 52° the efficiency of the radiation increases 70%. Results for the irradiation of the solid sol at about $-5°$ are discussed. The effects produced by γ-radiation are similar to those produced by *X*-rays. The dose necessary to produce max. change in the potential of the sol varies with the quality of the radiation but there is insufficient evidence to indicate whether the phenomenon depends on the λ of the radiation. W. R. A.

Influence of electrolytes on the viscosity of a ferric hydroxide sol. (MLLE.) S. THÉVENET (Compt. rend., 1938, **207**, 68—71).—$Fe(OH)_3$ sol, dialysed for 25 hr., and containing 35·7 g. of Fe_2O_3 per l., was flocculated by KCl, NaCl, NH_4Cl, $BaCl_2$, and $AlCl_3$. The cation has no clear influence. Flocculation by KCl, K_2SO_4, K_3PO_4, and $K_4Fe(CN)_6$ depends on the valency of the anion in a manner analogous to the influence of the valency of the cation on the flocculation of As_2S_3 sol. W. R. A.

Viscosity and jelly formation of concentrated sols of hydrous stannic oxide. C. I. VARADANAM (Proc. Indian Acad. Sci., 1938, **7**, **A**, 327—332).—The particle size, derived from data relating to the depolarisation of scattered light, increases with progressive dialysis. The particles are spherical. No relation between η and increase in particle size has been observed. The amount of adsorbed NH_3 decreases, rapidly at first, as dialysis proceeds. E. S. H.

Form in colloidal systems. A. KING and N. STUART (Chem. and Ind., 1938, 745—748).—An account of work previously published (A., 1938, I, 357). F. L. U.

Influence of hydrogen-ion concentration on the surface tension of some colloidal solutions.—See A., 1938, III, 527.

Limited and unlimited swelling of high-molecular substances. E. BRODA (Nature, 1938, **142**, 116).—Theoretical. The transition limited → unlimited swelling of long-chain mols. is discussed. L. S. T.

Optical study of isothermal and non-isothermal sol → gel transformations. W. HELLER and E. VASSY (Compt. rend., 1938, **207**, 157—159).—The various types of gelation can be explained by a single process, the observed differences being due to the speed with which gelation proceeds. This is in contradiction to Heymann's classification of gelation processes (A., 1936, 427). An optical investigation of an aq. thixotropic solution of gelatin supports the theory put forward. W. R. A.

Heteropolar molecules. W. KERN (Z. physikal. Chem., 1938, **182**, 145—146; cf. A., 1938, I, 312).—A reply to Kipli's criticism. H. J. E.

Heteropolar molecules. S. KIPLI (Z. physikal. Chem., 1938, **182**, 147—148; cf. preceding abstract). —Polemical. H. J. E.

Anomalous case of emulsification. D. F. CHEESMAN, A. KING, and J. N. SUGDEN (Nature, 1938, **141**, 1099).—Simple salts such as the alkali halides enable relatively stable emulsions of H_2O in $C_5H_{11}\cdot OH$ to be prepared. The salts are not surface-active, but tend to increase rather than decrease the interfacial tension of the system. The stability of the emulsion is not simply related to salt concn. With KI as stabilising agent, max. stability appears to be reached at a concn. of 0·05N, and concns. > N inhibit emulsification completely. L. S. T.

Separation of emulsions. D. F. CHEESMAN and A. KING (Kolloid-Z., 1938, **84**, 100—101).—A reply to criticism by Nagelstein. Further experiments show that the stability of emulsions of aq. KCl in amyl alcohol is not influenced by adsorbed or mechanically included air, but is increased by dissolved air. (Cf. A., 1938, I, 310.) E. S. H.

Velocity of coagulation of colloids. K. JABŁCZYŃSKI (Rocz. Chem., 1938, **18**, 45—68).—A review. R. T.

Stabilisation of kaolin suspensions by soluble phosphates. E. M. NATANSON (Mem. Inst. Chem. Ukrain. Akad. Sci., 1938, **5**, 165—175).—The particle sizes of kaolin suspensions have been determined by a sedimentation method. The dispersity was increased by small amounts of Na_2HPO_4 more strongly than by Na_2SiO_3, and Na_2CO_3 had the least effect. Larger amounts of Na_2HPO_4 decrease the dispersity. J. J. B.

Stabilisation of colloids by electrical ionisation.—See A., 1938, III, 693.

Sedimentation volume and thixotropy. H. AKAMATU (Bull. Chem. Soc. Japan, 1938, **13**, 456—462).—Measurements are recorded of the sedimentation vols. (V) of glass, ZnO, talcum, $CaCO_3$, graphite, charcoal, and C black for various pure liquids (*e.g.*, H_2O, EtOH, $COMe_2$, C_6H_6, and PhMe), and also for solutions in these liquids of oleic, palmitic, benzoic, and acetic acids, tripalmitin, lecithin, and hexyl alcohol. If the powder is a polar substance (*e.g.*, ZnO, talcum) V in a pure non-polar liquid is always > that in a polar liquid. For non-polar powders (*e.g.*, graphite) there is no obvious dependence on the nature of the liquid. For a polar powder in a non-polar solvent, a polar solute decreases V. If both the powder and the solvent are polar, or the powder is non-polar, a polar solute has no effect on V. All the powders examined formed thixotropic systems in non-polar liquids. There is a parallelism between large vals. of V and the thixotropic nature of the system. H. J. E.

Negative thixotropy. G. S. HARTLEY (Nature, 1938, **142**, 161).—Solutions of the Cu salt of cetyl Ph ether sulphonic acid and various other paraffin chain salts show the phenomenon of elastic recoil to a more marked extent than does NH_4 oleate. L. S. T.

Swelling of charcoal. V. Saturation and immersion expansions and the heat of wetting. D. H. BANGHAM and R. I. RAZOUK (Proc. Roy. Soc., 1938, **A**, **166**, 572—586; cf. A., 1935, 29).—The linear expansion of a rod of inactive wood charcoal is measured in a specially designed extensometer and it is found that exposure to saturated vapour of MeOH produces a smaller expansion than immersion in the liquid. The expansion ∝ the lowering of surface energy of the charcoal. From estimates of the sp. surface of the charcoal, vals. are derived for the changes of free and total energy per sq. cm. which accompany saturation and immersion. G. D. P.

Rhythmic precipitation of some pyrophosphates. (MLLE.) S. VEIL (Bull. Soc. chim., 1938, [v], **5**, 1072—1073).—Experiments with Zn, Cd, Mn, and Cu pyrophosphates are described. C. R. H.

Co-precipitation of silver bromide and chromate [in gelatin]. (MLLE.) S. VEIL (Compt. rend., 1938, **206**, 1896—1897; cf. A., 1937, I, 616).—On allowing a drop of aq. $K_2Cr_2O_7$ and KBr to diffuse into gelatin impregnated with $AgNO_3$, the drop becomes surrounded with a continuous zone of AgBr, surrounded in turn by a Liesegang ring system of Ag_2CrO_4. On keeping, the KBr diffuses into the Ag_2CrO_4 rings and partly converts them into AgBr, the rings retaining their positions in the original system. The K_2CrO_4 formed in this second reaction diffuses further into the gelatin and produces a second distinct system of Ag_2CrO_4 rings. A. J. E. W.

Ageing and properties of precipitates. XXII. Induced precipitation of mercuric sulphide from sodium mercuric sulphide solutions by zinc sulphide. Post-precipitation. I. M. KOLTHOFF, F. S. GRIFFITH, and D. R. MOLTZAU (J. Amer. Chem. Soc., 1938, **60**, 1576—1582).—HgS is post-pptd. with ZnS from aq. Na_2HgS_2 under conditions such that the resulting liquid phase is not supersaturated with respect to HgS. The phenomenon of post-pptn. occurs only when HgS is sol. in the primary ppt. and the rate of separation of the latter is > the rate of dissociation of HgS_2'' into HgS and S''. The distribution coeff. of HgS between the aq. solution and the solid phase has been determined. The rate of attainment of equilibrium between aq. Na_2HgS_2 and ZnS serves to indicate the degree of perfection and

progress of ageing of ZnS ppts. ZnS pptd. at p_H 1·15 is more perfect and ages more rapidly than that pptd. at p_H 5. E. S. H.

Electrokinetic potential [of glass in aqueous dioxan, ethyl alcohol, and acetone]. K. KANAMARU, T. TAKADA, and K. AIKAWA (J. Soc. Chem. Ind. Japan, 1938, **41**, 108—117B).—The ζ-potentials of glass in aq. solutions of dioxan, EtOH, and $COMe_2$ have been obtained by the use of a modified Briggs apparatus. Coehn's rule does not hold for any of the systems. The ζ-potential is given by $\zeta = 10^m(D - D_0)P_{1.2}^n$ where $D - D_0$ is the difference between the dielectric const. for liquid and glass, $P_{1.2}$ the mol. polarisation of the solution, and m and n are consts. which are approx. the same for all the systems. W. A. R.

Effect of cations on electrophoretic mobility of tristearin at constant p_H. D. I. BREESE and W. C. M. LEWIS (Trans. Faraday Soc., 1938, **34**, 787—793; cf. A., 1933, 778).—The mobility of purified tristearin emulsions has been measured in aq. NaCl, $BaCl_2$, $AlCl_3$, $LaCl_3$, and $ThCl_4$ at p_H 4. The results of Roberts (A., 1937, I, 79) are confirmed. Measurements with $AlCl_3$ and $ThCl_4$ are complicated by the formation of colloidal hydrolysis products. With $Na^{\cdot}$, $Ba^{\cdot\cdot}$, and $La^{\cdot\cdot\cdot}$ limiting vals. of the mobility without reversal are obtained, and the results agree closely with the requirements of Gouy's theory. In all cases the charge density increases with electrolyte concn. F. L. U.

Application of cryolysis. VI. Mechanism of the aggregation and disaggregation of organic colloids at low temperature. L. HOLZAPFEL and F. F. NORD (Ber., 1938, **71**, [B], 1217—1225).—Experiments with polyacrylic acids in H_2O and in 0·002% to 2% NaOH and with Et polyacrylate in EtOH, $CH_2Ph{\cdot}OH$, C_6H_6, and PhMe indicate that homopolar colloids in non-polar solvents exhibit aggregation under the action of frost; these colloids in polar solvents exhibit, on the other hand, disaggregation which not only is reversible but also leads in part to a higher state of aggregation. Heteropolar colloids in polar solvents show both aggregation and disaggregation. The aggregation effect appears to be due to van der Waals forces. Disaggregation on the other hand is due to electrostatic and dipolar forces between the ions. H. W.

Cellulose–neutral salt solutions. H. ERBRING and H. GEINITZ (Kolloid-Z., 1938, **84**, 25—42).—The swelling of cellulose (I) in dil. aq. $Ca(CNS)_2$ and its dissolution in >52% aq. $Ca(CNS)_2$ have been studied. The temp. variation of the η of solutions of const. (I) content and varying $[Ca(CNS)_2]$ shows that the concn. coeff. of η is high at low temp., but at >60° practically const. η vals. are obtained. The η of solutions with const. $[Ca(CNS)_2]$ has a max. at low concn. of (I). EtOH and $COMe_2$ have a greater pptg. action on (I)–$Ca(CNS)_2$ solutions than H_2O; small amounts of EtOH produce max. η. The degree of adsorption of $Ca^{\cdot\cdot}$ by (I) has been determined. Partial dissolution of (I) in aq. $Ca(NO_3)_2$ occurs only under high pressure; (I) cannot be dissolved in aq. $CaCl_2$. Other solvents for (I) are aq. $Al(CNS)_2$, $AlCl_3$, $ZnCl_2$, NaCNS, K_2HgI_4, and $HgCl_2$ + NaCl. E. S. H.

Adsorption and swelling of α-cellulose. (MME.) J. GAVORET (Compt. rend., 1938, **207**, 65—66).—The electrical conductivity method (A., 1938, I, 357) has been applied to α-cellulose (I). The resistance of very dil. buffered solutions of (I), from wood and from cotton, and the Δp_H have been determined. The results indicate that the cation is adsorbed as hydroxide, that (I) does not show swelling in H_2O which varies with p_H, and that both samples of (I) are identical. W. R. A.

Lyophilic properties of cellulose and its derivatives. XV. ζ-Potential of cellulose nitrate. K. KANAMARU, T. TAKADA, and K. MAEDA (J. Soc. Chem. Ind. Japan, 1938, **41**, 153—159B).—The changes of ζ-potential of cellulose nitrates of varying N content in H_2O, MeOH, and EtOH have been determined after various periods of immersion. Immediately after immersion in the liquid the ζ-potential is the higher the greater is the capacity of the liquid to cause swelling of the cellulose nitrate. The greater is the difference between the initial and final potentials ($\zeta_0 - \zeta_\infty$) the greater is the swelling. Very highly swollen nitrate, before dissolution occurs, has zero potential. W. A. R.

Electrokinetic investigations on the lyophilic properties of cellulose derivatives. IV. ζ-Potential of cellulose nitrate. K. KANAMARU, T. TAKADA, and K. MAEDA (Kolloid-Z., 1938, **84**, 42—50; cf. A., 1938, I, 355).—A detailed account of work already noted (see preceding abstract). E. S. H.

Physico-chemical properties of saponins. II. State of hydration of sapoalbin. R. RUYSSEN and E. O. K. VERSTRAETE (Natuurwetensch. Tijds., 1938, **20**, 96—102).—Measurements of the Gortner effect and η show that hydration of the sapoalbin sol is very small. η increases to a const. val. on the addition of NaOH, decreases continuously with NaCl, reaches a sharp min. with $BaCl_2$ or $AlCl_3$, and rapidly reaches a const. min. with $Th(NO_3)_4$. κ shows that aggregation occurs on freezing solutions containing >2·5% and segregation occurs with more dil. solutions. S. C.

Isoelectric point of mixtures of gelatin with amino-acids. R. E. LIESEGANG (Kolloid-Z., 1938, **84**, 24).—Diffusion experiments show that aspartic and p-aminobenzoic acids form compounds with gelatin, the isoelectric points of which are at higher p_H than those of the components. E. S. H.

Osmotic pressure, mol. wt., and stability of gliadin. N. F. BURK (J. Biol. Chem., 1938, **124**, 49—70).—Osmotic measurements show that gliadin (I) has a mol. wt. of 41,000 in EtOH solution. The mol. wt. in $CO(NH_2)_2$ solution is 44,000, but varies with the temp. of the pptn. from 60% EtOH. The stability of (I) in $CO(NH_2)_2$ solution is very high, the osmotic pressure being const. over a p_H range of 2—11. The mol. wt. in glycerol and urethane solutions is 67,000 and 74,000, respectively. The presence of ·S·S· groups in (I), indicating denaturation, is found only in $CO(NH_2)_2$ solution, and the change

is reversible. The increased mol. wt. in glycerol and urethane and the variation of mol. wt. with pptn. temp. are ascribed to the presence of aggregates of partly coagulated (I). In salt-free urethane solutions (I) has mol. wt. 42,000. A. T.

Viscosimetric behaviour of solutions of methylstarch.—See A., 1938, II, 221.

Reversal of charge and flocculation of negative biocolloids with alkaloid salts. I, II. H. G. B. DE JONG and J. G. WAKKIE (Biochem. Z., 1938, **297**, 70—80, 221—243).—I. The concn. of alkaloid salt required to reverse the charge on the particles of an EtOH-sol. soya-bean phosphatide sol is in the order: quinine < strychnine < novocaine < guanidine. The same order is observed for the alkaloid nitrates and sulphates. When the concn. for reversal is low, the nitrates and chlorides have almost the same val. Antagonism is exhibited when mixtures of alkaloid chlorides with NaCl or $CaCl_2$ are added to the sol.

II. The above order of charge reversal concns. for alkaloid salts holds for egg lecithin, EtOH-insol. soya-bean phosphatide, Na nucleate, Na arabate, Na pectate, Na carragheen, and K chondroitin sulphate. With the phosphate colloids the reversal order for alkali cations is K < Na < Li, but with the carboxylate and sulphate colloids the order is Li < Na < K. In general, the concn. of alkaloid chloride or nitrate required for reversal depends on the composition of the ionised groups of the biocolloid, the density of charge of the colloid anion, and the chemical structure of the alkaloid ion. E. S. H.

Negative, non-amphoteric biocolloids as high-molecular electrolytes. II. Cation series in charge reversal by neutral salts. Analogies with the solubility series of corresponding low-molecular electrolytes. P. H. TEUNISSEN and H. G. B. DE JONG (Kolloid-Beih., 1938, **48**, 33—92; cf. A., 1938, I, 311).—The concn. of neutral salt required to reverse the charge for the particles of sols of egg lecithin, EtOH-sol. and -insol. soya-bean phosphatide, Na nucleate, Na arabate, Na pectinate, Na pectate, Na oleate, K chondroitin sulphate, Na carragheen, and Na agar has been determined. 23 electrolytes, with cation valencies 1—6, have been investigated. The order of the cation series varies for the different colloids, but in each case agrees with the order of solubilities of salts of the same cations with simple anions of similar type to the colloid anion. The influence of size, valency, and polarising power of the cation, and polarisability of the anion on charge reversal and solubility is discussed. The following general relations are observed when the ionogenic group of the colloid is more strongly polarisable than the H_2O mol.: (1) the crit. concn. for reversal decreases with increasing valency of the cation, (2) for ions of equal valency in the same group of the periodic table the crit. concn. decreases with decreasing size of the cation, (3) for ions of equal valency the crit. concn. is less for the sub-groups than for the main groups of the periodic table. When the ionogenic group of the colloid is less strongly polarisable than the H_2O mol., the order of the cations is reversed. Exceptions to these generalities have been observed and are discussed. E. S. H.

Behaviour of microscopic bodies consisting of biocolloid systems and suspended in an aqueous medium. I. Pulsating vacuoles in coacervate drops. II. Formation of double-refractive membranes on gelatin gel globules by tannin. H. G. B. DE JONG (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 643—645, 646—650).—I. Pulsating vacuoles are observed in coacervate drops of gum arabic sol + toluidine-blue under certain conditions when these are not in equilibrium with their medium. The biological significance of the phenomenon is discussed.

II. The prep. of microscopic globules of gelatin gel by coacervation of a gelatin sol in presence of $(NH_4)_2SO_4$, cooling, and washing is described. The globules are microscopically homogeneous and show no evidence of double refraction. Dil. tannin solutions produce on the surface of the globules a membrane which shows strong double refraction. E. S. H.

Thermal dissociation of oxygen. H. VON WARTENBERG (Z. anorg. Chem., 1938, **238**, 299—304).—Since O atoms combine with O_2 to form O_3, which is relatively long-lived and easily determined, the dissociation of O_2 can be detected experimentally in the hot-and-cold tube. Vals. obtained for the partial pressure of the O atoms are $0{\cdot}14 \times 10^{-6}$ atm. and $1{\cdot}9 \times 10^{-6}$ atm. at 1010° and 1150°, respectively, in agreement with thermodynamical calculation. F. J. G.

Stability of chlorine–water vapour mixtures in light. J. E. CLINE and G. S. FORBES (J. Amer. Chem. Soc., 1938, **60**, 1699—1700).—Experiments are described which indicate the absence of any photochemical reaction between Cl_2 and H_2O vapour. E. S. H.

Dissociation of some calcium salts. I. GREENWALD (J. Biol. Chem., 1938, **124**, 437—452).—The apparent solubility products (A) for $CaSO_4$, $Ca_3(PO_4)_2$, and $CaCO_3$ are increased in presence of many org. Ca salts; the relative effects of the latter in increasing the solubility are similar in each of the three cases. Ca glycerophosphate (I) is, however, exceptional in its behaviour, in that increased vals. of A are obtained with $CaSO_4$ and $CaCO_3$, whilst the val. of A is lowered in the case of $Ca_3(PO_4)_2$. It has been shown that (I) is adsorbed on $Ca_3(PO_4)_2$ and that $Ca_3(PO_4)_2$ accelerates the decomp. of (I). The possible formation of mixed complexes and the physiological significance of the data are discussed. C. R. H.

Dissociation of hydrogen ions from the sulphates of aminophenylboric acids. C. S. CLEAR and G. E. K. BRANCH (J. Org. Chem., 1938, **2**, 522—534).—Dissociation consts. have been determined for phenylboric acid, for *o*-, *m*-, and *p*-amino- and -benzamido-phenylboric acids, and for *m*-hydroxyphenylboric acid. Zwitter ion formation is not indicated. The results are said to afford evidence of (*a*) resonance in the *o*- and *p*-NH_2-acids, (*b*) smaller, but still appreciable, resonance in the *m*-NH_2-acid, (*c*) a H-bridge in the *o*-NH_2-acid, (*d*) the negative character of NH_2 and neutral character of $B(OH)_2$, and (*e*) that the first H lost from (I) is that of the OH. R. S. C.

Dissociation constants of some enols related to ascorbic acid. Tetronic, α-chloro-, -bromo-, -iodo-, and -hydroxy-tetronic acids, and ethyl α-iodoacetoacetate.—See A., 1938, II, 217.

Electrometry of *d*-araboascorbic and glucoheptoascorbic acid.—See A., 1938, II, 347.

Unilateral triple ion formation in aqueous hydrofluoric acid. C. B. WOOSTER (J. Amer. Chem. Soc., 1938, **60**, 1609—1613).—The conductance function for unilateral triple ion formation (cf. A., 1937, I, 189) applies satisfactorily to conductance data for aq. HF at 0° and 25°. The consts. agree with independent vals. obtained from transference measurements. E. S. H.

Certain properties of aqueous sodium xanthate. L. FILIPCZYK (Rocz. Chem., 1938, **18**, 103—106).—The turbidity which appears in solutions of Na xanthate prepared with H_2O distilled from a Cu still (A., 1936, 1078) is ascribed to traces of Cu in the H_2O, and is obtained when double-distilled H_2O (from glass) is kept over Cu or Sn, but not Zn or Al. R. T.

Variations of different physico-chemical properties of naphthalene as a function of p_H. (MLLE.) M. GEX (Compt. rend., 1938, **207**, 153—155).—The ultra-violet spectrum of $C_{10}H_8$ has been studied as a function of p_H and attempts to verify the existence of an isoelectric point between p_H 3·7 and 10·5 have been made. The data indicate that in aq. solution $C_{10}H_8$ behaves as an ampholyte. W. R. A.

Ionisation in non-aqueous solvents. I. Formation of complex cyanides. W. L. GERMAN (J.C.S., 1938, 1027—1031).—The reactions between KCN and $AgNO_3$, $CuCl_2$, $HgCl_2$, $CdCl_2$, and $NiCl_2$, respectively, in MeOH and EtOH have been studied. In each case the reaction is closely similar to that observed in aq. solution. E. S. H.

Ethylenediamine as an ionising solvent. G. L. PUTNAM and K. A. KOBE (Trans. Electrochem. Soc., 1938, **74**, Preprint, 61—75).—The physical properties of $(CH_2{\cdot}NH_2)_2$ have been examined with a view to its use as a polar solvent in place of liquid NH_3. For solutions of NaI, NaBr, $NaClO_4$, and KI d varies linearly with the concn. and the temp. coeff., 0·00088 g. per c.c. per °c., is identical with that for pure solvent. The conductivity of the solutions also varies linearly with the concn., the temp. coeff. being 3% per °c. Solutions of S in $(CH_2{\cdot}NH_2)_2$ conduct readily but are unstable at room temp., NH_3 being evolved. Successful preliminary experiments on the electrodeposition of Mg, Li, Na, and K are described. C. R. H.

Solvolysis and neutralisation in liquid sulphur dioxide. K. WICKERT (Z. Elektrochem., 1938, **44**, 410—412).—The following reactions, which may be represented as solvolysis and neutralisation respectively, occur in liquid SO_2: (1) $ZnEt_2 + SO_2 = ZnO + Et_2SO$; (2) $MgO + SOCl_2 = MgCl_2 + SO_2$. Ca, Ba, Zn, and Fe^{III} oxides behave similarly. The cell $Pt|O_2|$liquid $SO_2|HgBr|Hg$ gives a steady e.m.f. of approx. 0·2 v. These results show that liquid SO_2 ionises into $SO^{\cdot\cdot}$ and O'' and is thus analogous to H_2O. F. J. G.

Cryoscopic study of copper and silver halides in benzene or ethylene dibromide solutions of aluminium bromide. E. J. GORENBEIN and I. M. SLAVUTSKAJA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 23—38).—Complexes of the type $MX,AlBr_3$ and $MX,2AlBr_3$ are formed when MX (M = Cu^I, Ag; X = Cl, Br, I) is added to $AlBr_3$ in C_6H_6 or $C_2H_4Br_2$. The complexes undergo association when X = Cl or Br, but not I, and this change is more pronounced with Ag than with Cu^I, and in C_6H_6 than in $C_2H_4Br_2$. R. T.

Cryoscopic study of the systems $AlBr_3$–$PhNO_2$ and NaCl or KCl–$AlBr_3$–$PhNO_2$. J. F. MESHENNI and P. P. TUROV (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 85—99).—Anomalous changes in the f.p. of solutions of $AlBr_3$ in $PhNO_2$ are not observed when NaCl or KCl is added to the solutions. In view of the rise in conductivity the process taking place is represented as $MCl + AlBr_3 \rightarrow MCl,AlBr_3 \rightleftharpoons AlBr_3Cl' + M^{\cdot}$. R. T.

Interpretation of activity measurements. C. W. DAVIES (Trans. Faraday Soc., 1938, **34**, 804—805).—Conclusions reached by Stonehill (A., 1938, I, 250) are criticised. F. L. U.

Activity coefficients of lead chloride in aqueous solutions of mannitol at 25°. H. D. CROCKFORD and J. C. LOFTIN (J. Amer. Chem. Soc., 1938, **60**, 1607—1608).—Activity coeffs. and a parameter vals., derived from e.m.f. data, are shown to decrease with increasing concn. of mannitol. E. S. H.

Activity and osmotic coefficients of tervalent metal chlorides in aqueous solution from vapour pressure measurements at 25°. C. M. MASON (J. Amer. Chem. Soc., 1938, **60**, 1638—1647).—Osmotic coeffs. for aq. solutions of $AlCl_3$, $ScCl_3$, YCl_3, $LaCl_3$, $CeCl_3$, $PrCl_3$, and $NdCl_3$ have been determined by the isotonic method, and the activity coeffs. calc. The data are discussed. E. S. H.

Approximate thermodynamic calculations. P. DROSSBACH (Metall u. Erz, 1936, **33**, 173—177; Chem. Zentr., 1936, ii, 34).—The approximation $\Delta Z = Q_1 - T.\Delta S_1$ (ΔZ = change in thermodynamic potential, Q_1 = heat of reaction, ΔS_1 = change in entropy) is valid when Q_1 is large and ΔS_1 is not too small, but is not accurate for reactions which involve gases or the formation (or disappearance) of polyat. mols. J. S. A.

Thermodynamic properties of solutions of amino-acids and related substances. III. Ionisation of aliphatic amino-acids in aqueous solution from 1° to 50°. P. K. SMITH, A. C. TAYLOR, and E. R. B. SMITH (J. Biol. Chem., 1937, **122**, 109—123).—Thermodynamic ionisation consts. for *dl*-alanine, *dl*-α-amino-*n*-butyric and -*n*-valeric acid, *dl*-norleucine, α-amino*iso*butyric acid, *dl*-valine, *dl*-leucine, and *dl-iso*leucine have been determined from 1° to 50°. Vals. of $p_{K_{max.}}$, temp. of max. ionisation, and of ΔF, ΔH, and ΔS for the ionisation process are calc. J. L. C.

Experimental verification of Ostwald's observation on the evolution of chemical systems. A. TIAN (Bull. Soc. chim., 1938, [v], **5**, 1030—1033).—

Consideration is given to the fact that a spontaneous chemical change rarely leads to a state of equilibrium which corresponds with the min. potential of the system. Experiments on the pptn. of HgI_2 and on the relative solubilities of the red and yellow varieties are described, and it is shown that modification of the conditions may lead to a contradiction of the Ostwald rule. C. R. H.

Activity of nitrobenzene in binary systems with aromatic halogen compounds. K. Hrynakowski and M. Szmyt (Z. physikal. Chem., 1938, **182**, 110—116; cf. A., 1937, I, 464).—Eutectic data recorded are: with PhCl, 21·7% $PhNO_2$, m.p. −50·7°; with *p*-$C_6H_4Cl_2$, 78% $PhNO_2$, m.p. −6·8°; with *p*-$C_6H_4Cl{\cdot}OH$, 58·5% $PhNO_2$, m.p. −24·5°; with $C_6H_2Cl_3{\cdot}OH$ (I), 84·5% $PhNO_2$, m.p. 2·0°. A 1 : 1 compound, m.p. 28·7°, is formed with (I). The theoretical crystallisation curves and activity coeffs. for $PhNO_2$ have been calc.; the latter are slightly > 1 and increase only slightly with the concn. of the second component. Compound formation with (I) is probably due to dipole association. H. J. E.

Equilibrium diagrams of the binary systems CaO,SiO_2,TiO_2–MgO,TiO_2, $CaO,MgO,2SiO_2$–MnO,TiO_2, and CaO,SiO_2–$2CaO,Fe_2O_3$. K. Iwase and U. Nisioka (Sci. Rep. Tôhoku, 1938, **26**, 592—603).—Equilibrium data for the three systems have been determined. In the first the eutectic point corresponds with 1305° and 32 wt.-% MgO,TiO_2, in the second with 1183° and 48% MnO,TiO_2, and in the third with 1183° and 45% CaO,SiO_2. The diagrams were determined in each case by microscopic examination of specimens quenched at various temp. In the last case thermal analysis was also used. All three binary systems are of simple eutectic type, showing neither solid solution nor compound formation. C. M. A.

System Bi_2O_3–N_2O_5–H_2O. J. N. Friend and D. A. Hall (Trans. Faraday Soc., 1938, **34**, 777—783).—Isothermals have been determined at 0—85°. Below 65° the results agree with those of Rutten (A., 1902, ii, 386) except in the strongly acid region. The quintuple point at about 85°, $Bi(NO_3)_3,5H_2O$ + acid salt + basic salt, corresponds with Bi_2O_3 45·5%, N_2O_5 35·5%. F. L. U.

Ternary systems. XXIV. Calcium sulphate, sodium sulphate, and water. A. E. Hill and J. H. Wills (J. Amer. Chem. Soc., 1938, **60**, 1647—1655).—Solubility data have been determined at 25°, 35°, 50°, and 70°. The existence of $Na_2SO_4,CaSO_4$ and $2Na_2SO_4,CaSO_4,2H_2O$ is confirmed, and that of $Na_2SO_4,5CaSO_4,3H_2O$ established. E. S. H.

Equilibrium in the aluminium sulphate–sulphuric acid–water system at 25°, and the separation of $Al_2(SO_4)_3,18H_2O$ and $Al_2(SO_4)_3,16H_2O$. T. Motida (Sci. Rep. Tôhoku, 1938, **26**, 611—617).—Experimental procedure and apparatus are described. $Al_2(SO_4)_3,18H_2O$ represents the solid phase from 0 to 7·24%, and $Al_2(SO_4)_3,16H_2O$ from 7·81 to 48·13% H_2SO_4. The difference between these results and those of Wirth (A., 1913, ii, 221) is attributed to the paucity of experimental points on which Wirth's results were based and to the slight difference in the composition of the two solid phases. C. M. A.

Systems $CuSO_4$–$NiSO_4$–H_2O and $CuSO_4$–$CoSO_4$–H_2O. T. S. Suratkar, S. M. Mehta, and M. Prasad (Proc. Indian Acad. Sci., 1938, **A**, **7**, 393—398).—Solubility data at 40° afford no evidence of double salt formation. E. S. H.

Ternary systems ceric sulphate–alkali sulphate–water. II, III. Ceric sulphate–ammonium sulphate–water. I. W. Schröder [with E. Kehren and K. Frings]. **II.** W. Schröder [with H. van Poelvoorde] (Z. anorg. Chem., 1938, **238**, 209—224, 305—320).—I. Equilibrium diagrams for 0°, 25°, 50°, 75°, and 99·5° are given. In addition to the known compounds a *dihydrate* of $Ce_2(SO_4)_3,(NH_4)_2SO_4$ exists. The salt formerly regarded as $Ce_2(SO_4)_3,5(NH_4)_2SO_4$ is probably $Ce_2(SO_4)_3,4(NH_4)_2SO_4$.

II. The above work has been extended by the determination of the 28°, 33°, 38°, and 85° isotherms. $Ce_2(SO_4)_3,(NH_4)_2SO_4,8H_2O$ is always metastable with respect to $Ce_2(SO_4)_3,(NH_4)_2SO_4,2H_2O$, although the rate of transformation is very low even in presence of nuclei of the latter. F. J. G.

Sublimation and mutual diffusion of salts and metals. T. Peczalski (Compt. rend., 1938, **206**, 1728—1729; cf. A., 1926, 461).—On heating Fe_2O_3 at 800° in a sealed Cu tube, slow formation of thread-like Cu single crystals occurs. A Cu rod heated to 850° with $NiCl_2$ in a porcelain tube becomes covered with a cryst. Cu–Ni alloy; in an Fe tube a deposit of Cu and Ni forms on the walls, $NiCl_2$ and $FeCl_3$ penetrating the Cu rod and forming a porous structure. Similar reactions occur on long heating of Cu with KCl, NaCl, $CaCl_2$, and CaF_2 at 700—800° in porcelain tubes. The mechanism of these processes is discussed. A. J. E. W.

System Na–NaCl–NH_3. Solubility of sodium chloride in liquid ammonia in presence of metallic sodium: vapour pressure and density of the solution. S. Sigetomi, S. Abe, and R. Hara (J. Soc. Chem. Ind. Japan, 1938, **41**, 125—126B; cf. A., 1933, 1240; 1935, 818).—Results are given for 0°, −9°, −11°, and −20°. Precautions were taken to avoid formation of $NaNH_2$. The solubility of NaCl decreases rapidly with increase of [Na]. I. C. R.

Solid solutions of calcium ferrite in calcium aluminate produced by sintering. D. S. Belianкin, N. A. Toropov, and T. M. Diuko (Trans. Inst. Cements, U.S.S.R., 1937, No. 18, 57—73).—The formation of solid solutions of CaO,Fe_2O_3 in CaO,Al_2O_3 by sintering has been investigated. The concn. of the solid solution shows a max. (4·14% CaO,Fe_2O_3 at 1200°) with 10% of CaO,Fe_2O_3. At 1200° the presence of CaO,Al_2O_3, $3CaO,Al_2O_3$, and $5CaO,3Al_2O_3$ has been noted; at 1300° the stable phase is CaO,Al_2O_3 and $3CaO,Al_2O_3$ disappears, whilst at 1400° $5CaO,3Al_2O_3$ also disappears. D. G.

Evaluation of spatial solubility diagrams. II. Application to three- and four-sided prism diagrams. J. d'Ans and A. Arens (Kali, 1938,

32, 106—124).—The graphical methods previously described (cf. B., 1936, 541) have been extended to cases of isothermal and polythermal crystallisation with special reference to the systems $2KCl + MgSO_4 \rightleftarrows K_2SO_4 + MgCl_2$ and $KCl + NH_4NO_3 \rightleftarrows KNO_3 + NH_4Cl$. C. R. H.

Heats of hydration and transition of calcium sulphate. E. S. NEWMAN and L. S. WELLS (J. Res. Nat. Bur. Stand., 1938, **20**, 825—836).—The heats of dissolution at 25° in 2·09N-HCl of $CaSO_4,2H_2O$, $CaSO_4,0{\cdot}5H_2O$, natural anhydrite, and anhyd. $CaSO_4$ have been determined calorimetrically. The heats involved in the hydration, to $CaSO_4,2H_2O$, of $CaSO_4,0{\cdot}5H_2O$ and of anhydrite prepared at 1000°, are 4100 ± 30 and 3990 ± 20 g.-cal. per mol., respectively. The heat involved in the hydration to $CaSO_4,2H_2O$ of sol. anhydrite prepared by dehydrating $CaSO_4,2H_2O$ at 75° is < 6990 g.-cal. per mol. *X*-Ray and microscopic studies indicate two forms of anhyd. $CaSO_4$, viz., sol. anhydrite and a modification formed at high temp., the latter being identical with natural anhydrite; the heat involved in the transition of sol. to natural anhydrite is < 3000 g.-cal. per mol. M. R.

Heat of dissolution in benzene and toluene of aluminium bromide and its complex compound with potassium bromide. V. A. PLOTNIKOV and S. I. JAKUBSON (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 119—125).—Dissolution of $AlBr_3$ in H_2O evolves 91·5 kg.-cal., and decomp. of a solution of $AlBr_3$ in C_6H_6 or PhMe evolves 92·9 or 92·2 kg.-cal., respectively. The corresponding vals. for $KBr,2AlBr_3$ are 164·0, 157·1, and 160·6 kg.-cal. J. J. B.

Limiting conductivities of organic acids in aqueous solutions. J. F. J. DIPPY (Phil. Mag., 1938, [vii], **26**, 93—98).—Vals. of Λ_0 at 25° are recorded for Na acrylate, vinylacetate, and allylacetate. W. R. A.

Total hydration of the ions of barium nitrate. F. BOURION and E. ROUYER (Compt. rend., 1938, **206**, 1967—1969).—In 0·125M aq. solution of $Ba(NO_3)_2$ the hydration of the $Ba^{\cdot\cdot}$ ion corresponds with $Ba^{\cdot\cdot},22{\cdot}5H_2O$ compared with $Ba^{\cdot\cdot},20{\cdot}1H_2O$ for 0·25M-$BaCl_2$ solution (A., 1937, 1, 362). The difference may be explained by dilution effects. W. R. A.

Complexes. C. DUVAL (Bull. Soc. chim., 1938, [v], **5**, 1020—1030).—A general discussion of the formulæ to be ascribed to various types of complex. A simplified method for measuring ionic migration and its application to the examination of complexes are described. C. R. H.

Electrochemical study of the system ammonium halide–aluminium bromide–benzene. V. A. PLOTNIKOV, I. V. BARMASCHENKO, and E. B. GITMAN (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 3—21).—The sp. conductivity κ of the systems NH_4X–$AlBr_3$–C_6H_6, at 18—50°, is a max. when $[AlBr_3]:[NH_4X] = 2:1$, and varies in the order X = Cl > Br > I. The val. of $\kappa \propto$ concn. of the solutions. During electrolysis of the systems Al is deposited at the Pt cathode (Al anode), at a decomp. potential of about 2 v. R. T.

Transference numbers of potassium acetate in aqueous solution. D. J. LE ROY and A. R. GORDON (J. Chem. Physics, 1938, **6**, 398—402).—Transference nos. for aq. solutions of KOAc have been determined by a moving-boundary method at 25° and at concns. varying from 0·01N to 0·25N. Up to 0·16N the transference nos. can be represented by the Shedlovsky–Longsworth equation and give a val. of 0·6428 for the cation at infinite dilution; this val. agrees closely with that obtained from the limiting ionic mobilities. W. R. A.

Reproducibility of the silver–silver chloride electrode. E. R. SMITH and J. K. TAYLOR (J. Res. Nat. Bur. Stand., 1938, **20**, 837—847).—Neither light nor dissolved air has any significant influence on the reproducibilities of the potentials of the electrolytic, thermo-electrolytic, and thermal types of electrode in 0·05N-KCl. A marked ageing effect, which may amount to 1 mv., is due to concn.-polarisation occurring during the prep. of the electrode. Attainment of concn.-equilibrium is slow and depends on the porosity of the electrodes and on the stirring of the solution; if sufficient time is allowed, the same potentials (within 0·02 mv.) are obtained. M. R.

Volta effect in solid metallic alloys. II O. SCARPA [with C. ROSSI] (Atti R. Accad. Lincei, 1938, [vi], **27**, 57—62; cf. A., 1938, I, 314).—The Volta effect with respect to pure Cu of Cu–Zn alloys has a max. val. at 90 wt.-% Zn. This may indicate the existence of the compound $CuZn_6$, but an alternative explanation is discussed. O. J. W.

Diffusion potential. VI. V. ČUPR (Publ. Fac. Sci. Univ. Masaryk, 1937, No. 248, 3—15; cf. A., 1938, I, 84).—The conditions under which Planck's general equation, which is valid for mixtures of electrolytes, leads to the same diffusion potential as Henderson's equation are formulated. The relation $r_1/r_x + r_2/r_x + r_1/r_2 = 0$ is discussed, where r_2/r_1 is the diffusion potential between solutions R_2 and R_1, r_1/r_x and r_2/r_x are the diffusion potentials between solutions R_1 and R_2, respectively, and solutions R_x prepared by mixing R_1 and R_2 and inserted between them. Planck's general equation satisfies this relation under conditions such that it reduces to the same form as Henderson's equation. The above relation can be derived from Nernst's general equation. E. S. H.

Adsorption on the dropping mercury electrode in connexion with the maxima of the polarographic current–voltage curves. A. WINKEL and H. SIEBERT (Z. Elektrochem., 1938, **44**, 402—410).—Current–voltage and electrocapillary curves for a dropping Hg electrode in presence of reducible substances (NO_2-compounds) have been studied. The max. of the current–voltage curves depend markedly on p_H. Existing theories do not account for the phenomena, and it is suggested that an accumulation of reduction products in the interface plays a part. F. J. G.

Oxidation–reduction potential developed by solutions of vitamin-*C* in presence of oxygen. N. BEZSSONOFF and (MME.) N. WOLOSZYN (Compt. rend., 1938, **206**, 1885—1887).—The oxidation–

reduction potential at 20±1° is given by $E = 0{\cdot}2925 - 0{\cdot}0582 \log c^{0{\cdot}46}$ v. for concns. $>0{\cdot}1$N, or $E = 0{\cdot}309 - 0{\cdot}0582 \log \{c^{0{\cdot}46}/(c^{2{\cdot}17} + 0{\cdot}52)\}$ v. for all concns. The variation of the rate of oxidation of vitamin-*C* with the initial concn. in a buffer solution at p_H 2·6 has been examined, and equations are given which represent the degree of oxidation after a given time in its dependence on *E*. A. J. E. W.

Application of the properties of polished electrodes to the study of the zone of the transitory electrolytic Beilby layer. F. J. Tabourv (Compt. rend., 1938, **206**, 1953—1955; A., 1937, I, 310).—A polished electrode, dipping in an electrolyte, can be raised electrostatically to a potential considerably > that of the electrolyte. Equalisation of the potential takes place very slowly. The potential is greatly influenced by the nature and dimensions of the transitory layer. The charging and discharging of polished electrodes, dipping in H_2SO_4, have been investigated. The zone of the transitory layer possesses the properties of a small condenser shunted by a large resistance. W. R. A.

Decomposition voltage of fused magnesium chloride. K. Sano (Sci. Rep. Tôhoku, 1938, **26**, 604—610).—The free energy change for the decomp. of fused $MgCl_2$ represented by $MgCl_2$ $(l) = Mg$ $(l) + Cl_2$ is given by $F^\circ = 156{,}322 + 13{\cdot}197T \log_e T - 0{\cdot}0005T^2 - 124{\cdot}71T$. From this equation the calc. decomp. voltages of fused magnesite are 2·66 and 2·61 v. at 700° and 800°, respectively. Mol. and at. heats as well as heats of fusion are given and the relation of the results to those previously obtained is shown graphically. C. M. A.

Electrode potentials and decomposition voltages of solutions of halides in acetone. E. M. Skobetz (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 177—195).—E.m.f. measurements for cells of the type Zn|1N-$ZnBr_2$ in $COMe_2$|a solid mixture of AgBr and Ag_2S|1N-KCl in $H_2O|Hg_2Cl_2|Hg$ have been measured when a current of variable c.d. passes between the Zn and a third electrode. In addition to Zn and $ZnBr_2$, Co, Cd, Bi, Cu, and Hg and their halides have been used. The sum of the electrode potentials thus obtained agrees with the decomp. voltage. J. J. B.

Decomposition potentials at various current densities. O. K. Kudra (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 127—135).—$Cu(NO_3)_2$, $CuCl_2$, $CuSO_4$, $CdSO_4$, and $AgNO_3$ were used. For c.d. leading to a smooth metal deposit the decomp. potential is independent of the concn. When the c.d. is so high that a black powder is deposited, the decomp. potential decreases with increasing concn. The theory is advanced that the black powders are due to discharge of complex ions. J. J. B.

Direct method of determining the polarisation voltage using a rotating electrode. Application to the study of copper deposition from sulphate solutions at high current densities. A. A. Boulach (Trans. Electrochem. Soc., 1938, **74**, Preprint 8, 10 pp.).—The cathode polarisation data obtained agree well with the formula $E = RT \log_e (1 + AD^b)/nF$ where E = cathode polarisation voltage, D = actual c.d. in amp. per sq. m., n = valency, and A and b are consts. Vals. of the latter are recorded for various temp., c.d., and compositions of the solutions. Cathode polarisation is attributed solely to a change in activity of $Cu^{\cdot\cdot}$ in the cathode film. Examination of the cryst. structure of the cathode deposits shows that with low *E* the deposit consists of large oriented crystals. With $E = 0{\cdot}08$—$0{\cdot}09$ v., fine non-oriented crystals are obtained, but further increase in *E* gives oriented crystals of a wood-like structure. The data point to a max. *E* of approx. 0·15 v. C. R. H.

Explanation of corrosion processes by superposition of electro-chemical partial processes, and the potentials of mixed electrodes. C. Wagner and W. Traud (Z. Elektrochem., 1938, **44**, 391—402).—The dissolution of a metal (*e.g.*, Zn amalgam) in an acid may be represented as the sum of independent electrochemical partial processes [Zn (in Hg) $= Zn^{\cdot\cdot} + 2e^-$, and $2H^\cdot + 2e^- = H_2$] without the assumption of local elements, and the process is discussed in terms of electrode potentials and the current–voltage curves for the two partial processes. The potential of the mixed electrode and the rate of the reaction are defined by these, together with the condition that (for an electrically isolated metal) the anodic and cathodic partial currents are equal. Measurements of the rate of dissolution of amalgamated Zn in HCl give results in agreement with the theory. The reaction between an oxidising agent in solution and H_2 on Pt is treated in the same way, and experiment shows, in agreement with the theory, that the reaction between $K_2S_2O_8$, H_3AsO_4, or $PhNO_2$ and H_2 on Pt ceases when the Pt is externally polarised to the equilibrium potential of the H electrode. The potentials of poisoned H electrodes are also to be regarded as mixed potentials. F. J. G.

Effect of pressure on the passivity of various metals. C. A. Littler and H. V. Tartar (Trans. Electrochem. Soc., 1938, **74**, Preprint, 45—59).—Fe anodes in H_2SO_4 remain active on reduction of pressure if the metal projects above the surface of the solution, but if the exposed metal is covered with wax it becomes passive almost at once, and can be made active again only by reducing c.d. Periodic behaviour is exhibited with the wax covering below the surface and ceases with the wax at the surface of the solution. When the middle of the immersed electrode is covered, the Fe surfaces above and below the wax are simultaneously active or passive. Similar experiments have been carried out with anodes of Ni in H_2SO_4, Cu in HCl, and Al in HNO_3, and although they remain active under reduced pressure, they behave differently when protected by wax. The effect of stirring has also been investigated. The destruction of periodicity by a wax covering offers a strong argument against the theory that periodicity depends on an alternate depletion of ions in the vicinity of the metal followed by replacement through diffusion. The observations also do not support a theory based solely on the formation of gas films. C. R. H.

Passivity of chromium and ferrochromium in acid solutions. V. Čupr and O. Lasák (Publ.

Fac. Sci. Univ. Masaryk, 1938, No. 253, 3—16).—The c.d. required for passivation of a Cr anode in aq. H_2SO_4 decreases with increasing surface of electrode and with increasing dilution. The chemical passivation of Cr in acid solutions, caused by introduction of O_2 or O_3, has been studied by means of potential–time curves. Potentials characterising the behaviour of Fe–Cr (64·8% Cr) electrodes on passivation have been determined. Similar passivity phenomena have been observed in steels containing Cr and Mo; the variation of their dissolution potentials with the acidity of the solution has been studied. E. S. H.

Passivity of iron to natural waters. U. R. EVANS (Nature, 1938, **142**, 160—161).—Preliminary abrasion followed by etching of the "shattered" metal, and treatment with a solution containing Cl′ and CrO_4'' in amounts adjusted to remove susceptible spots while leaving the remainder passive, considerably delays the rusting of Fe or mild steel in soft moorland or hard, chalky waters. The delay of the rusting decreases with specimen size. The method does not prevent rusting by a polluted atm. Engraving a scratch line does not necessarily lead to rusting, probably because the invisible protective film is pressed into the groove, so that the Fe remains largely covered. L. S. T.

Mechanism of electrolytic processes. IV. Cathode-ray oscillograph study of anodic passivation of gold in chloride solutions. J. D. PEARSON and J. A. V. BUTLER (Trans. Faraday Soc., 1938, **34**, 806—812).—Experiments at high c.d. show that the relationship previously found (A., 1935, 39) still holds. It is suggested that ions used up at the electrode can be replaced by diffusion until the diffusion layer reaches a const. thickness of about 4×10^{-4} cm. F. L. U.

Rôle of the degree of ionisation of electrolytes in the structure of the transitory electrolytic Beilby layer. Comparison with Raman data. F. J. TABOURY (Compt. rend., 1938, **207**, 138—140).—From observations on conductivity H_2O and on solutions of H_2SO_4 of various concns. it is inferred that the nature and degree of ionisation of the electrolyte influence considerably the structure of the Beilby layer. Solutions of $<50\%$ H_2SO_4 have characteristics different from those of solutions of $>50\%$ H_2SO_4. The appearance of "new" displacements in Raman spectra of H_2SO_4 on dilution and the persistence of these at concns. $<50\%$ H_2SO_4 have been noted. (Cf. A., 1938, I, 461.) W. R. A.

Electrolysis in the glow discharge. VIII. Measurements of the fall [of potential] at the cathode and anode in some electrolytic solutions. A. KLEMENC and H. MILLERET (Z. physikal. Chem., 1938, **40**, B, 252—262; cf. A., 1937, I, 419; 1935, 475, etc.)—Measurements have been made at different distances from the metal and liquid electrodes using an auxiliary electrode and equipotential lines derived for both the anode and the cathode. The character of the glow discharge in a gas when one of the electrodes is an electrolyte is much the same as when both electrodes are metallic. T. H. G.

Glyoxalines. Determination of p_K values and use of their salts as buffers. A. H. M. KIRBY and A. NEUBERGER (Biochem., J., 1938, **32**, 1146—1151).—The p_K vals. of glyoxaline and its Me, Ph, and $OH{\cdot}CH_2$ substitution products have been determined and in combination with HCl these compounds are proposed as buffers for the range p_H 5·4—9·3. P. G. M.

"Integrative action" of mixtures of simple organic substances in oxidation–reduction phenomena produced by autoclaving. J. W. WILLIAMS (J. Lab. clin. Med., 1938, **23**, 527—531).—The persistence of reduction of methylene-blue after autoclaving at 15 lb. pressure for 20 min. is more pronounced with mixtures of org. acids and sugars at p_H 8·0 than at p_H 5·6; the effect is also observed with mixtures of *d*-glutamic acid and cysteine hydrochloride at p_H 5·0 but not at p_H 8·0 whilst mixtures of *d*-glutamic acid, cysteine hydrochloride, and glucose show a vacillatory state of partial reduction and partial oxidation in solutions of p_H 5·0 but not p_H 8·0. C. J. C. B.

Buffer action of unidentified urine constituents. —See A., 1938, III, 497.

Electrochemical investigation of the systems of aluminium bromide with ethyl iodide and lithium, sodium, and potassium halides. I. L. KATZNELSON and C. M. AIZENBERG (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 137—164).—Alkali halides are insol. in EtI. Their solubility in solutions of $AlBr_3$ in EtI increases with $[AlBr_3]$; it rises in the series K < Na < Li. The conductivity of dil. $AlBr_3$ solutions is lowered by alkali halides, and that of conc. solutions is increased. Mixtures of $AlBr_3$ with alkali iodides have a lower conductivity than those with alkali chlorides or bromides, and mixtures containing K conduct < those containing Na. Decomp. potentials do not vary with the composition of the solution and seem to agree with that of AlI_3 (1·26—1·29 v.), which presumably is formed in the solution. J. J. B.

Nature of chemical reactivity. H. W. MELVILLE (Proc. Roy. Inst., 1938, **30**, 358—377).—A lecture.

Irreversible processes at the absolute zero of temperature. C. J. GORTER (Physica, 1938, **5**, 483—485).—The rule is proposed that the velocity of irreversible processes vanishes at 0° K.; this may apply only in cases where Nernst's law is obeyed. A. J. E. W.

Temperature distribution in a reaction vessel and the stationary theory of thermal explosions. D. A. FRANK-KAMENECKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 413—414).—Theoretical. Expressions are derived for the stationary temp. distribution in the reacting mixture, and for the crit. conditions for inflammation. The contribution of convection to the heat loss is important only at higher pressures. H. J. E.

Kinetics of the decompositions of the lower paraffins. E. W. R. STEACIE (Canad. Chem., 1938, **22**, 325—327).—A review of published work. E. S. H.

Explosive decomposition of acetylene with ignition.—See A., 1938, II, 345.

Inflammation of *n*-propyl ether. J. BARON and P. LAFFITTE (Compt. rend., 1938, **206**, 1386—1387).—The inflammation temp. (195—215°) of a no. of Pr_2O–O_2 mixtures at 100—600 mm. total pressure are recorded. Addition of N_2 lowers the ignition temp., in agreement with the chain theory. Induction periods of $\gtrsim$4—5 sec. are observed. A. J. E. W.

Highly polymerised compounds. CXCIII. Formation of polymerised substances by condensation equilibria. I. G. V. SCHULZ (Z. physikal. Chem., 1938, **182**, 127—144).—Theoretical expressions are derived for the polymerisation equilibrium and the mean degree of polymerisation in reversible polymerisation processes (*e.g.*, polyester formation) in which the product (H_2O) is allowed to accumulate in the system. In the above instance careful removal of H_2O is necessary to secure a degree of polymerisation of 100. The effect of the reverse reaction on the rate of polymerisation and the relationship between linear and three-dimensional polymerisation are discussed. H. J. E.

Kinetics of the reaction between benzyl chloride and formic acid. L. S. HEBLE and T. S. WHEELER (Proc. Indian Acad. Sci., 1938, **A**, **7**, 411—415).—The reaction has been studied at 80°, 90°, and 100°. The rate decreases with increasing [CH_2PhCl] and is much slower than that calc. from the heat of activation. It is assumed that HCO_2H reacts in an activated form, of which only traces are present. E. S. H.

Thermal decomposition of visual purple.—See A., 1938, III, 653.

Reduction of ions of nickel, cobalt, iron, and other metals by zinc amalgam. A. S. RUSSELL and J. C. CARVER (Nature, 1938, **142**, 210—211).—In dil. aq. H_2SO_4, $CdSO_4$ or $CuSO_4$ is reduced by Zn–Hg $\lesssim$1000 times as fast as $FeSO_4$ solution under similar conditions and 100—500 times as fast as $NiSO_4$ and $CoSO_4$. Similar differences in the rates of reduction are found when no metal is present as, *e.g.*, when a solution of $U_2(SO_4)_3$ or UCl_3 is used as the reducing agent. The main cause of the slowness of reduction appears to be the state of the ions to be reduced, for when Ni, Co, or Fe is present as complex ions reduction to metal by Zn–Hg sometimes occurs rapidly. The blue solution of $CoCl_2$ in conc. HCl ($CoCl_4''$) is reduced to Co immediately, but the simple $Co^{\cdot\cdot}$ ion of pink aq. or dil. acid solutions is not reduced. The groupings around the simple cation appear to be the chief hindrance to the electrons which would convert ion into metal atom. Further evidence in support of this view is discussed. L. S. T.

Rate of exchange of hydrogen atoms between sugar and water. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 427—436; cf. A., 1936, 569).—The exchange reaction between D_2O (in the form of 4·7% D_2O) and glucose, fructose, glycerol, or $(CH_2{\cdot}OH)_2$ is established within 1 min. in either neutral, acid, or alkaline solution. The distribution coeff. of D between the OH groups of hexoses and H_2O had the mean val. $\alpha = 1{\cdot}15$. H. J. E.

Kinetics of hyponitrous acid. E. ABEL and J. PROISL. I. Hyponitrite in alkaline solution. E. ABEL, A. ORLICEK, and J. PROISL (Monatsh., 1938, **72**, 1—21).—Apparatus for the prep., in solution, of pure $H_2N_2O_2$ is described. Decomp. in alkaline solution takes place thus: $Na_2N_2O_2 + H_2O = N_2O + 2NaOH$. The velocity is given by $-d(N_2O_2'')/dt = d(N_2O)dt = k(N_2O_2'')/[OH']\{1 + \gamma[OH']\}$. The temp. coeff. is of tho order of 5·5 per 10°. Hyponitrite is stable in alkaline solution at room temp. but at 100° is so rapidly decomposed as to be non-existent. O. D. S.

Critical increment of ionic reactions. III. Influence of dielectric constant and ionic strength. J. LANDER and W. J. SVIRBELY (J. Amer. Chem. Soc., 1938, **60**, 1613—1617; cf. A., 1938, I, 202).—The rate of the reaction $NH_4CNO \rightarrow CO(NH_2)_2$ has been determined at 30—60° in $(CH_2{\cdot}OH)_2$–H_2O mixtures at const. ϵ of 63·5, 60, 55, 50, 45, and 40. The influence of ionic strength on the observed crit. increments at zero ionic strength is in good agreement with equations previously derived. The crit. increment is independent of ϵ. The influence of ϵ of the solvent on the rate coeff. is in fair agreement with the Scatchard–Christiansen theory. E. S. H.

Velocity of the reaction $CH_2Br{\cdot}COO' + S_2O_3'' \rightarrow S_2O_3{\cdot}CH_2{\cdot}COO'' + Br'$, in aqueous organic solvents. II. L. FILIPCZYK (Rocz. Chem., 1938, **18**, 117—119).—The velocity coeff. k of the reaction rises, and the energy of activation falls, with increasing concn. of glycerol, at 20°; at 30° k is max. for 50 vol.-% glycerol. (Cf. A., 1938, I, 362.) R. T.

Reduction of potassium permanganate by cyclic hydrocarbons. A. J. J. VAN DE VELDE (Natuurwetensch. Tijds., 1938, **20**, 124—127).—The oxidation of C_6H_6, *cyclo*hexane, PhMe, *o*-, *m*-, and *p*-xylene, and *s*-$C_6H_3Me_3$ by 0·01N-$KMnO_4$ in acid solution under standard conditions at 100° is described. It is possible to determine quantitatively the reducing powers of sparingly sol. volatile compounds in this way. S. C.

Kinetic considerations on combination reactions. A. J. RUTGERS (Natuurwetensch. Tijds., 1938, **20**, 105—112).—The effect of high pressure on k is discussed mathematically and corr. data are given for the following reactions studied previously by other investigators: EtOAc and NaOH in H_2O at 2·04° to 1500 atm. (Cohen and Kaiser, A., 1915, ii, 246), hydrolysis of Et methoxycinnamate in dil. aq. EtOH to 1500 atm. (Moesveld, A., 1923, ii, 746), hydrolysis of bornyl acetate in dil. aq. EtOH (Moesveld and de Meester, A., 1929, 149), NaOEt and EtI in EtOH to 12,000 atm., $CH_2Cl{\cdot}CO_2Na$ and NaOH in H_2O to 12,000 atm., C_5H_5N and EtI in $COMe_2$ to 8500 atm., NMe_2Ph and $Pr^{\beta}I$ in $COMe_2$ to 12,000 atm. (Perrin, A., 1938, I, 147). S. C.

Velocity of the Cannizzaro reaction. J. J. BLANKSMA and W. H. ZAALJER (Rec. trav. chim., 1938, **57**, 727—728).—k for the reaction 2PhCHO + KOH (etc.) $\rightarrow$ KOBz + $CH_2Ph{\cdot}OH$ in 50% MeOH at

100° are: $Ba(OH)_2$ or $Sr(OH)_2$ 0·07 [also for $Ba(OH)_2$ in 40% MeOH], $Ca(OH)_2$ 0·3. For $Ba(OH)_2$ in 50% EtOH $k = 0·15$, but the formation of appreciable amounts of MeCHO and consequent resinification obscure the results. Smaller amounts of CH_2O are detectable as formed in MeOH. R. S. C.

Kinetics of the formation of Mg_3Cd and $MgCd_3$ from solid solutions of Mg–Cd alloys. I. I. KORNILOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 157—160; A., 1937, 1, 508).—Dilatometric data show that the rates of formation of Mg_3Cd and $MgCd_3$ from solid solutions of Mg and Cd follow the unimol. law. L. S. T.

Parabolic law of oxidation. G. D. PRESTON (Phil. Mag., 1938, [vii], **26**, 65—82).—The type of pressure–time relation which will be observed when oxidation experiments are carried out at const. vol. is discussed. The oxidation of Cu (cf. Wilkins and Rideal, A., 1930, 1129) obeys the parabolic law provided that the const. of the law is assumed ∝ pressure of O_2. A logarithmic pressure–time relation is consistent with the law, and molten Pb experimentally gives such a relation. The observation of Wilkins (*loc. cit.*) that a large rate of oxidation is observed when the pressure of O_2 over Cu is suddenly increased may bear on the problem of corrosion-fatigue. W. R. A.

Combustion and detonation in solid explosives.—See B., 1938, 986.

Transient inhibition of the thermal decomposition of butane by nitric oxide. L. S. ECHOLS and R. N. PEASE (J. Amer. Chem. Soc., 1938, **60**, 1701).—The inhibition (A., 1937, 1, 314) is a transient effect, terminating when only a fraction of NO has reacted. The phenomenon can be explained quantitatively by the assumption that NO forms an unstable compound with chain carriers (R, presumably free radicals), leading to the equilibrium $R + NO \rightleftharpoons NOR$. E. S. H.

Catalytic oxidation of iodides by persulphates. III. Catalytic activity of aromatic diamines and aminophenols in relation to their structure and to the reaction conditions. IV. Influence of hydrogen-ion concentration and of the "substrate" on the activity of organic catalysts. V. Poisoning of organic catalysts by various "substrates." P. V. AFANASIEV (J. Phys. Chem. Russ., 1938, **11**, 231—236, 237—241, 242—247).—III. The reaction between KI and $K_2S_2O_8$ in presence of starch and a small amount of $K_2S_2O_3$ is accelerated by p-$C_6H_4(NMe_2)_2 > p$-$NH_2·C_6H_4·NMe_2 > p$-$C_6H_4(NH_2)_2 > 1:2:4$-$OH·C_6H_3(NH_2)_2 > p$-$OH·C_6H_4·NH_2 > o$-$C_6H_4(NH_2)_2 > p$-$C_6H_4(NMe_2Cl)_2 > 1:2:4:6$-$OH·C_6H_2(NH_2)_3 > o$-$OH·C_6H_4·NH_2 > p$-$C_6H_4(OH)_2 > m$-$C_6H_4(NH_2)_2$. The amines were used as hydrochlorides or hydrosulphates; the p_H of the solution was unknown. The high catalytic activity of p-compounds as compared with that of m-compounds suggests the formation of a quinonoid form as an intermediate compound.

IV. The catalytic activity of amines depends largely on the composition of the solution. It is small in presence of borates and phosphates, and high in presence of veronal buffers. At p_H 6·8—7·4 it shows a max. for all the amines investigated. The max. is especially sharp, and the activity is very high, for benzidine. $K_2S_2O_3$ poisons the catalysts.

V. $CS(NH_2)_2$, cysteine, and Et malonate lower the activity of the amines when the p_H is allowed to change but do not poison the catalysts in buffered solutions. The activity of p-$C_6H_4(NMe_2)_2$ in $CS(NH_2)_2$ solutions is ≫ in $K_2S_2O_3$ solutions, but the [H·] corresponding with the max. activity is almost unchanged. J. J. B.

Kinetics of the catalysed polymerisation of styrene. II. Inhibition of stannic chloride catalysis by hydrogen chloride. G. WILLIAMS (J.C.S., 1938, 1046—1052; cf. A., 1938, I, 204).—In CCl_4 and at room temp., $CHPh{:}CH_2$ and HCl react to form CHPhMeCl, distyrene, and short-chain polystyrene, $SnCl_4$ acting as a catalyst. Inhibition of long-chain polymerisation is attributed to the capture by HCl of those $CHPh{:}CH_2$ mols. which would otherwise start polymerisation chains. It appears probable that initial inhibition periods observed in polymerisations with unpurified $SnCl_4$ are due to the presence of HCl as impurity. C. R. H.

Organic catalysts. Esterase model.—See A., 1938, II, 357.

Theory of heterogeneous catalysis. M. BRUTZCUS (Compt. rend., 1938, **206**, 1730—1732; cf. A., 1925, ii, 215).—According to the theory discussed, dissociation of gas mols. adsorbed on the catalyst is facilitated by resonance with intramol. vibrations in the catalyst. Efficient catalysis is to be expected when coincidences occur between lines in the spectra of the catalyst and of one or more of the gases involved in the reaction. A. J. E. W.

Reduction of silver ions by hydrogen adsorbed on silica gel. L. G. MAIDANOVSKAIA (J. Phys. Chem. Russ., 1938, **11**, 277—278).—SiO_2 gel saturated with H_2 at 500° reduces $AgNO_3$ solutions. A gel saturated at room temp. is inactive. J. J. B.

Catalytic properties of the platinum oxides. P. LAFFITTE and P. GRANDADAM (Cong. Chim. ind. Bruxelles, 1935, **15**, I, 319—323; Chem. Zentr., 1936, ii, 1297—1298; cf. A., 1935, 462).—O_2 on Pt-black at 430—450°/8·25 atm. forms PtO exclusively. At higher pressures of O_2 between 410° and 420° a mixture of PtO and PtO_2 is formed. Pure PtO_2 is obtained from it by dissolution of the PtO in aqua regia. The hydrogenation of α-pinene, PhOH, and piperonal at 100—460°, and of camphor and *o*-allylphenol at 460°, is described. PtO_2 is an excellent catalyst for the hydrogenation of C:C and C:O, and is much superior to Pt-black. A mixture of PtO (approx. 30%) and PtO_2, prepared by heating finely-divided Pt in O_2 at 410°/170 atm., is a better catalyst than Pt-black for the synthesis of SO_3 from SO_2 and O_2. L. S. T.

Catalytic effectiveness and sensitivity to poisoning of alloy-skeleton nickel. E. B. MAXTED and R. A. TITT (J.S.C.I., 1938, **57**, 197—200).—The effectiveness, for catalytic hydrogenation, of alloy-skeleton Ni—prepared by leaching out the Al component of a Ni–Al alloy by means of NaOH—has been compared with that of an equiv. mass of Ni in the

ordinary kieselguhr-supported form. Suitable hydrogenation temp. are not the same for the two types of Ni owing to the tendency of the unsupported alloy-skeleton to lose activity by sintering at relatively high temp., but, in the respective optimum temp. range of each, the effectiveness of unit wt. of kieselguhr-supported Ni was ~ twice that of unit wt. of the alloy-skeleton. The relative sensitivity to poisoning was also determined. In the specimens examined, the alloy-skeleton catalyst was somewhat less easily poisoned than the supported Ni.

Regeneration of spent [nickel] catalysts.—See B., 1938, 904.

Nickel catalysts in chemical industries.—See B., 1938, 923.

Catalytic hydrogenation of fats.—See B., 1938, 935.

Catalytic water-gas reaction. Mass transfer and catalyst activity.—See B., 1938, 867.

Contact poisons in the hydrogenation of ethylene.—See B., 1938, 883.

Mixed polymerisation of butenes by solid phosphoric acid catalyst.—See B., 1938, 877.

[Catalytic] chlorination of benzene with hydrogen chloride and air.—See B., 1938, 884.

Accelerators of vulcanisation of rubber.—See B., 1938, 946.

Catalytic oxidation of bornyl chloride.—See B., 1938, 885.

[Catalytic] production of formaldehyde by oxidation of gaseous products of pyrolysis and cracking.—See B., 1938, 884.

Cathode process in electrolysis of solutions of complex salts. A. GLAZUNOV (Chem. Listy, 1938, **32**, 246—249).—Theoretical. The processes taking place at the cathode during electrolysis of complex salts are discussed. R. T.

Reaction mechanism of the anodic formation of alkali chlorates. A. LOWY (Chim. et Ind., 1938, **40**, 31—32).—The const. ratio between the yields of O_2 and of chlorate observed by various investigators is attributed to an equilibrium in the immediate vicinity of the anode between OH′, OCl′, and Cl′. As a result of the hydrolysis of NaOCl the ratio [OH′]/[OCl′] is const., and in presence of alkali a large increase in [OH′] is prevented by interaction with Cl′ which has been formed during electrolysis at the same time as OCl′. C. R. H.

Electro-deposition of sodium from non-aqueous solutions. V. A. PLOTNIKOV and Z. A. JANKELEVITSCH (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 39—57).—The yield of Na deposited at the cathode in electrolysis of the system NaCl–$AlCl_3$–solvent (Al anode, Cu^I cathode; c.d. 1 amp. per sq. dm., at 4·3 v.) is max. when the solvent is 2 : 1 $PhNO_2$–xylene, and amounts to 60% on the current used. The process is complicated by formation of resinous products. Surface oxidation of the Na takes place to a certain extent. R. T.

Influence of non-electrolytes on the cathode efficiency of copper deposition. S. S. JOSHI, D. N. SOLANKI and T. V. S. RAO (J. Indian Chem. Soc., 1938, **15**, 167—175).—The deposition of Cu from acidified $CuSO_4$ solution has been investigated quantitatively in presence of different concns. of MeOH, EtOH, glycerol, and $COMe_2$. Cathode efficiency increases with increasing concn. of non-electrolyte up to a limiting val. owing to the reduced ability of the solution to redissolve the Cu deposited. A complex cation of Cu^{II} and the non-electrolyte may exist. With large excesses of $COMe_2$ and MeOH the cathode efficiency falls and this may be due to interaction between the medium and the conducting material. T. H. G.

Mechanism of electro-deposition of copper in presence of iron salts.—See B., 1938, 928.

Physicochemical factors in the electro-deposition of silver. S. S. JOSHI and S. PADMANABHAN (J. Indian Chem. Soc., 1938, **15**, 176—190).—A smooth, adherent deposit of Ag was best obtained when 0·05N-$AgNO_3$ was electrolysed for 38 min. at 26°, using a current of 7 ma. and an inter-electrode distance of 0·5 cm. The influence of gelatin, turpentine, or CS_2 was studied. The cathode efficiency of Ag has also been measured in the presence of MeOH, EtOH, and $COMe_2$ over a wide range of concns. of these non-electrolytes. Pronounced discontinuities in the curves connecting these quantities indicate the formation of complexes in the conducting media. Data are also given for conductivity, n, d, and (MeOH only) transport no. and η. T. H. G.

Electrolytic oxidation. X. Anodic oxidation of acid–ester salts. Mechanism of the Crum-Brown–Walker synthesis in aqueous solution. A. HICKLING and J. V. WESTWOOD (J.C.S., 1938, 1039—1046).—The influence of numerous factors on the electrolytic oxidation of $CO_2Et{\cdot}CH_2{\cdot}CO_2K$ (I) to $(CH_2{\cdot}CO_2Et)_2$ (II) has been investigated. There is an optimum c.d. of 0·12 amp. per sq. cm. Ester formation diminishes at low concns. of (I), in alkaline solutions, with rise in temp., and in presence of foreign inorg. anions. Of the various anode materials used, smooth and grey Pt were the most efficient. Ions which are good catalysts for the decomp. of H_2O_2 reduce considerably the efficiency of ester formation. Possible anodic mechanisms are discussed and rejected. It is suggested that H_2O_2 is formed as the primary product at the anode by irreversible combination of discharged OH′. In presence of sufficient (I), H_2O_2 then reacts to form (II). C. R. H.

Mechanism of the reduction of acetaldehyde at the dropping mercury cathode. G. SEMERANO and B. POLACSEK (Gazzetta, 1938, **68**, 292—295).—The reduction of MeCHO at the dropping Hg cathode is a univalent process: $MeCHO + H_2O + \ominus \rightarrow CHMe{\cdot}OH + OH'$, followed by $2CHMe{\cdot}OH \rightarrow [CHMe(OH){\cdot}]_2$. O. J. W.

Electrolysis in the glow discharge. VII. Catalytic influences on the electrode processes, especially by hydrochloric acid. A. KLEMENC and H. KALISCH (Z. physikal. Chem., 1938, **182**, 91—102; cf. A., 1937, 1, 419).—The oxidation of 2N-H_2SO_4

with the glow discharge is progressively decreased as the [HCl] in the H_2SO_4 is increased above 10^{-3} g.-mol. per l. HF has no action, but $KHSO_4$ increases the yield of oxidation products ($H_2S_2O_8$, H_2SO_5, and H_2O_2). HCl retards the reaction $2H_2SO_4 + 2H = H_2S_2O_8 + 2H_2$. The oxidation of H_2SO_4 takes place in the liquid phase. A [HCl] of 2×10^{-2} g.-mol. per l. in 2N-H_2SO_4 decreases the anode fall by 23 v. and increases the cathode fall by 12 v. H. J. E.

Exchange reactions with deuterium. II. Photochemical exchange between deuterium and hydrogen chloride. P. A. LEIGHTON and P. C. CROSS (J. Chem. Physics, 1938, **6**, 345—349; cf. A., 1936, 288).—Mixtures of HCl and D_2 and of DCl and H_2 were exposed to the radiation of the Zn spark and the exchange reactions investigated. Exchange is effected by a chain mechanism giving quantum yields of from 2 to 19. The chief rate-determining reactions are $Cl + D_2 \rightarrow DCl + D$ and $D + HCl \rightarrow HD + Cl$. The photostationary state is discussed. W. R. A.

Kinetics of the photochemical reaction of hydrogen with chlorine. F. S. PETROVA (J. Phys. Chem. Russ., 1938, **11**, 262—269).—Ichikawa's statement (cf. A., 1931, 47) that the rate of the reaction is large at zero time is disproved by new experiments. The increase of the pressure of the mixture agrees with Semenov's chain reaction theory. J. J. B.

Decomposition of mercury dimethyl. J. P. CUNNINGHAM and H. S. TAYLOR (J. Chem. Physics, 1938, **6**, 359—367).—The thermal and photochemical decomps. of $HgMe_2$ in the presence and absence of H_2 have been studied. Below 290° no measurable thermal decomp. occurs in the absence of H_2; at 348° the decomp. is relatively rapid and the products are C_2H_6, CH_4, and a carbonaceous deposit which is probably a CH_2 polymeride. No carbonaceous deposit is obtained in presence of H_2, the main product being CH_4. H_2 accelerates the decomp. Surface and pressure effects are discussed. Photochemical decomp. by an unfiltered hot Hg arc from 50° to 300° has been studied. In absence of H_2, C_2H_6 is formed almost exclusively at <200° and there is no carbonaceous deposit. In presence of H_2, there is again no carbonaceous deposit; CH_4 is, however, formed at all temp. and its amount increases as the temp. rises. Special tests showed that the effects were not produced by Hg resonance radiation and, also, that a mixture of H_2 and D_2 did not react to form 2HD. A mechanism is given involving the photodecomp. of $HgMe_2$ to free CH_3 radicals, which combine to give C_2H_6. To explain the presence of CH_4 the following reactions are postulated: in the presence of H_2, $CH_3 + H_2 \rightarrow CH_4 + H$; $H + HgMe_2 \rightarrow Hg + CH_4 + CH_3$; whilst, in the absence of H_2, $CH_3 + HgMe_2 \rightarrow CH_4 + CH_2{\cdot}HgMe$; $CH_2{\cdot}HgMe \rightarrow CH_2 + HgMe$ or $\rightarrow CH_2 + Hg + CH_3$; $CH_3 + CH_3 \rightarrow CH_4 + CH_2$. The activation energy of $CH_3 + H_2 = CH_4 + H$ is 9 ± 2 kg.-cal. W. R. A.

Optical sensitisation in solutions. I. Sensitised photolysis of aqueous silver nitrate solutions in presence of organic reducing agents. J. BOKINIK (J. Phys. Chem. Russ., 1938, **11**, 190—196).—$AgNO_3$ in pure gelatin is not reduced by visible or ultra-violet light (λ >250 mμ.). Reduction in ultra-violet light takes place in presence of 10^{-5} g.-mol. of KCl or KBr per l. of gelatin, and that in visible light occurs in presence of KI. $AgNO_3$–mannitol–rhodamine or –eosin mixtures are stable in ultra-violet light if the mixture has been ultra-filtered before irradiation. Traces of KCl sensitise the mixture. J. J. B.

Optical sensitisation of silver halides. V. Bleaching of the sensitising pigment in the photolysis of silver bromide. J. I. BOKINIK and Z. A. ILINA-BAGDASARIAN (J. Phys. Chem. Russ., 1938, **11**, 197—204).—The rate of formation of Ag depends on the initial concn. of the pigment (erythrosin) and is independent of the rate of bleaching, which can be varied by variation of $[O_2]$. Apparently the actual sensitiser is formed from AgBr and pigment at the beginning of the reaction. It may be identical with free Ag, which sensitises AgBr sols in absence of dyes. J. J. B.

Stability of the nuclei of the latent image.—See B., 1938, 984.

Photosensitivity of diphenylamine-*p*-diazonium sulphate by the method of photometric curves. C. F. GOODEVE and L. J. WOOD (Proc. Roy. Soc., 1938, **A**, **166**, 342—353).—The diazonium salt was bleached with light of λ 365 mμ. and was found to have a quantum efficiency of 0·34 independent of concn. and temp. The photosensitivity is unaffected by the removal of dissolved O_2 and by the addition of an internal filter (a yellow tartrazine dye, 1110 Baeyer). The absorption spectra of bleached and unbleached solutions is recorded in the range λ 250—450 mμ. The results are compared with those obtained from visual purple (cf. A., 1938, I, 261). G. D. P.

Luminescence phenomena during the oxidation of luminol.—See A., 1938, II, 365.

Hydrogen-deuterium exchange in acetone. A. I. BRODSKI and M. M. SLUZKAJA (J. Phys. Chem. Russ., 1938, **11**, 278—279).—After the exchange the water separated from $COMe_2$ by forming $Na_2B_4O_7,10H_2O$. The coeff. of exchange was 1·21. J. J. B.

Keto-enol tautomerism in light and heavy (deuterium) solvents.—See A., 1938, II, 348.

Inertia and chemical activity of the rare gases. IX. Thermal decomposition of the platinum–helium compounds. H. DAMIANOVICH and J. PIAZZA (An. Soc. cient. argentina, 1935, **120**, 205—207; Chem. Zentr., 1936, ii, 737).—The compounds formed by the action of He on Pt have two definite decomp. temp. (90—100° and 300—320°). 67% of the combined He escapes in this temp. range. H. J. E.

Preparation and properties of neutral lithium phosphate. A. A. SANFOURCHE (Compt. rend., 1938, **206**, 1820—1822).—The phosphate pptd. on adding an alkali phosphate solution containing excess of alkali to a Li salt solution contains LiOH, and probably consists of a mixture of Li_3PO_4 with $3Li_3PO_4,NaOH$; the latter salt, corresponding with hydroxyapatite, is obtained on long boiling of the

ppt. with the alkaline phosphate solution. The *salt* $Li_3PO_4,0{\cdot}5H_2O$ (I) is pptd. on mixing equiv. quantities of aq. H_3PO_4 and LiOH, or of aq. Na_3PO_4 and a solution of a neutral Li salt. The H_2O in (I) is constitutional, and (I) is probably $Li_6P_2O_8,H_2O$, derived from the acid $H_8P_2O_9$. The solubility of (I) in H_2O, which decreases rapidly on addition of alkali, is 0·375 g. per l. at 20°. A. J. E. W.

Sodium tetrametaphosphate. A. BOULLÉ (Compt. rend., 1938, **206**, 1732—1733; cf. A., 1937, I, 321).—At >410°, $Na_4(PO_3)_4$ undergoes irreversible transformation into the insol. metaphosphate, *B*; at higher temp. this undergoes the changes described previously (cf. A., 1938, I, 319). A. J. E. W.

Condensed phosphoric acids. Polyphosphates. P. BONNEMAN and M. BASSIÈRE (Compt. rend., 1938, **206**, 1379—1380; cf. A., 1937, I, 195).—The crystals of $Na_5P_3O_{10},6H_2O$ are pseudo-orthorhombic, occurring as twinned triclinic plates; a' 7·53±0·04, b 10·23±0·05, c' 9·83±0·05 A., a' and c' being the projections of the a and c axes on the (100) and (001) planes, respectively; the angle θ between these planes is 87° 30′. The vol. of the unit cell, containing two mols., is 757±12 cu. A.; $\rho = 2{\cdot}12$, in accord with the calc. val. The formation of a tetrametaphosphate $Na_6P_4O_{13}$ (Schwarz, A., 1895, ii, 445; Partington, A., 1928, 380) is not confirmed, the products of the reactions described being $Na_5P_3O_{10}$ contaminated with other phosphates. A. J. E. W.

Action of cæsium on carbon monoxide. L. HACKSPILL and L. A. VAN ALTNEA (Compt. rend., 1938, **206**, 1818—1820).—Cs rapidly absorbs CO at 0—100° forming a dark blue solid, which is converted by excess of CO into a yellow solid, $(CsCO)_n$ (I). (I) is insol. in C_6H_6, Et_2O, and liquid NH_3; it is slowly attacked by MeI in C_6H_6 solution, and dissolved by H_2O without evolution of gas. H_2 is without action at < 250°. 5—10% H_2SO_4 reacts with (I) giving $(CHO)_2$, indicating that $n = 2$; possible structures are CsO·C:C·CsO and Cs·C(:O)·C(:O)·Cs. A. J. E. W.

Ignition reactions in arsenides, especially of copper. W. SAVELSBERG (Metall u. Erz, 1936, **33**, 379—388; Chem. Zentr., 1936, ii, 1789).—The reversibility of the reactions between As_2O_3 and Cu, Ni, Ag, and Pt has been confirmed. Au is not attacked by As_2O_3. The normal pyroarsenate formed with Ni eliminates As_2O_3 when heated and is converted into basic arsenates, mainly $5NiO,As_2O_5$ and $10NiO,As_2O_5$. The difficulty of measuring equilibrium pressures in these reactions is discussed. The heat tone of the reactions and the heats of formation of the arsenides and arsenates have been calc. By heating in an atm. of SO_2 instead of air, the formation of arsenates can be hindered as SO_2 oxidises the As and reduces the As_2O_5. L. S. T.

Regulable preparation of very pure oxygen. H. VON WARTENBERG (Z. anorg. Chem., 1938, **238**, 297—298).—Apparatus is described in which a controlled stream of O_2 is generated by gradually lowering a platinised Ni foil into conc. H_2O_2. F. J. G.

Exchange reaction of oxygen atoms between water and some organic compounds. M. KOIZUMI and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 463—464).—The no. of interchangeable O atoms (shown in parentheses) was determined by treating the following compounds with H_2O enriched in the heavy O isotope at 100—130° for 1—45 hr.: glucose (1), PhCHO (1), BzOH (1), PhOH (<1), cinnamic acid (4), maleic acid (4), fumaric acid (2), *o*-$C_6H_4(CO_2H)_2$ (<1), *p*-$C_6H_4(CO_2H)_2$ (<1). H. J. E.

Corrosion of non-ferrous metals.—See B., 1938, 926.

Magnesium halogenocarbonates. (MME.) L. WALTER-LEVY (Compt. rend., 1938, **206**, 1898—1900; cf. A., 1937, I, 472; 1938, I, 207).—$MgCl_2,2MgCO_3,6H_2O$ is pptd. on adding aq. $Mg(HCO_3)_2$ to 4—5M-$MgCl_2$ at 70°. Similar *compounds*, $MgX_2,2MgCO_3,8H_2O$ (X = Br, I, ClO_3, NO_3) are prepared by similar reactions at 20°. A. J. E. W.

Gradual dehydration of alkaline-earth halides, investigated by the emanation method. C. LIEBER (Z. physikal. Chem., 1938, **182**, 153—166).—The dehydration of $BaX_2,2H_2O$ (X = Cl, Br, and I) and of $SiCl_2,2H_2O$ has been followed in moist as well as dry air by the emanation method using Th-*X*. Isotherms obtained at different temp. show successively no dehydration, formation of monohydrates, and complete dehydration. From the shapes of the curves qual. pictures of the velocities of the various processes can easily be obtained. T. H. G.

Synthesis of inyoite. A. V. NIKOLAEV and A. G. TSCHELISCHTSCHEVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 431—432).—A specimen of inyoite was obtained during a study of the system $CaO–B_2O_3–H_2O$ at 25°. It is the most labile of the Ca borates. H. J. E.

Active oxides. CXII. Preparation of neutral zinc carbonate, $ZnCO_3$. G. F. HÜTTIG, A. ZÖRNER, and O. HNEVKOVSKY (Monatsh., 1938, **72**, 31—41).—Details are given for the prep. of $ZnCO_3$ identical in crystal structure (*X*-ray) with smithsonite by pptn. from $ZnCl_2$ solution by $KHCO_3$. O. D. S.

Mol. wt. of certain complex compounds of aluminium bromide. Z. A. JANKELEVITSCH and I. A. SCHEKA (Mem. Inst. Chem. Ukrain. Acad. Sci., 1938, **5**, 59—83).—It is deduced, on the basis of cryoscopic measurements, that complexes of the types $MBr_3,AlBr_3$ and $MBr_3,2AlBr_3$ (M = As, Bi) are formed when MBr_3 is added to $AlBr_3$ in C_6H_6. A discussion of the results, together with those obtained by these and other authors for M = Sb, Ag, Cu^I, Li, Na, and K, leads to the conclusion that the stability of the complexes rises in the series As < Sb < Bi, Li < Na < K, Cu^I < Ag. The degree of association of the complexes and the sp. conductivity of the solution rise in the same order, and are greater at higher than at lower concns. It is supposed that the electrolyte is in all cases an associated complex. R. T.

Scandium sulphates and selenates. Z. TROUSIL (Coll. Czech. Chem. Comm., 1938, **10**, 290—304).—Prep. and certain properties of the following *Sc sulphates* and *selenates* are described: $Sc(SO_4)OH,2H_2O$; $Sc_2(SO_4)_3,4H_2O$ (also + $7H_2O$)

$H[Sc(SO_4)_2],2H_2O$; $Sc(SeO_4)OH,2H_2O$; $Sc_2(SeO_4)_3$ (also +5 and $10H_2O$). *Scandioselenic acid*, $H[Sc(SeO_4)_2],2H_2O$, and *Sc selenate-formate* $HCO_2{\cdot}Sc{\cdot}SeO_4,2H_2O$ are also described. The sulphates and selenates do not correspond with those of the other rare earths. K. W. P.

Gallium hydroxide having diaspore structure. J. Böhm and G. Kahan (Z. anorg. Chem., 1938, **238**, 350—352).—Pptd. Ga hydroxide after ageing under H_2O or heating with H_2O under pressure, followed by drying in vac. at 100°, has the composition Ga_2O_3,H_2O and the structure of diaspore with *a* 4·53, *b* 9·76, *c* 2·97 A. F. J. G.

Preparation of the rare earths. W. Prandtl (Z. anorg. Chem., 1938, **238**, 321—334).—Methods for the isolation of the individual earths are summarised. F. J. G.

Isolation of metallic europium. F. Trombe (Compt. rend., 1938, **206**, 1380—1383).—A Cd–Eu–Li–K alloy containing 2·7% Eu has been obtained by a method similar to that used for Gd (A., 1935, 456), but Eu and Li cannot be separated by vac. distillation. Electrolysis at ~700° of a mixture of $EuCl_3$ (40%) and NaCl–KCl eutectic (60%), using a Cd cathode, gives a Eu–Cd alloy in 60% yield. Eu (98% pure) is obtained by distillation of the alloy in an atm. of A, using Mo apparatus. The iron-grey product, m.p. 1100—1200°, is malleable and resembles Nd in hardness; it is not attacked by cold H_2O. A. J. E. W.

Affinity. LXXXIII. Combining power of titanium and phosphorus. W. Biltz, A. Rink, and F. Wiechmann (Z. anorg. Chem., 1938, **238**, 395—405).—The existence of a Ti phosphide of composition $TiP_{0\cdot92}$ (cf. A., 1908, ii, 597) has been confirmed by direct synthesis. *X*-Ray investigation indicates the existence of a *subphosphide*, Ti_2P. They are very resistant to acids and have no appreciable dissociation pressure at 1000°. A method for their analysis is described, and *X*-ray diagrams and data on ρ and mol. vol. for Ti–P preps. are given. F. J. G.

Mechanism of absorption of oxides of nitrogen by lead peroxide in micro-combustions. W. R. Kirner (Ind. Eng. Chem. [Anal.], 1938, **10**, 342—346).—The reactions between PbO_2 and NO_2 or NO under conditions similar to those existing in micro-combustions have been investigated quantitatively. Equations previously given do not conform to the data, which agree best with the equations $2PbO_2 + 2NO \rightarrow Pb(NO_2)_2,PbO + 0{\cdot}5O_2$ and $2PbO_2 + 2NO_2 \rightarrow Pb(NO_3)_2,PbO + 0{\cdot}5O_2$. L. S. T.

Phosphonitrile fluorides. O. Schmitz-Dumont and H. Külkens (Z. anorg. Chem., 1938, **238**, 189—200).—The reaction between triphosphonitrile chloride, $N_3P_3Cl_6$, and AgF, ZnF_2, or (best) PbF_2 affords a mixture of fluorinated products from which *tetraphosphonitrile dichlorohexafluoride*, $N_4P_4Cl_2F_6$, m.p. −12·4° to −12·1°, b.p. 105·8°, $\rho^{13\cdot5}$ 1·8742, has been isolated. Its v.p. is given by $\log p = 7{\cdot}923 - 1911/T$, from which $L = 8746$ g.-cal and the Trouton const. = 23·07. The mol. wt. in C_6H_6 and from the v.d. at 140° agrees with the formula given; at higher temp. the vapour depolymerises, but at 300° under pressure polymerisation to a rubber-like mass occurs. H_2O hydrolyses it slowly, alkalis rapidly. Another product is the *compound* $N_3P_3F_6,2HF,2H_2O$, colourless volatile crystals, m.p. 32·5°. F. J. G.

Constitution of vanadium carbide. A. Morette (Bull. Soc. chim., 1938, [v], **5**, 1063—1069).—Chemical, metallographic, and *X*-ray analyses indicate that the carbide corresponds with the cubic V_4C_3, which may contain graphite in solid solution if the total C is > that corresponding with V_4C_3. C. R. H.

Ammonium vanadates. P. Dubois and P. Breton (Compt. rend., 1938, **206**, 1969—1972).—The thermal decomp. of NH_4VO_3 has been investigated by a balance with photographic recording (A., 1936, 954) and dilatometrically. At about 200° the trivanadate, $(NH_4)_2V_6O_{11}$, is formed; decomp. of this sets in at 275° and by about 400° it is completely converted into V_2O_5. There appears to be an intermediate stage with formation of a compound of incompletely determined composition. The balance method has been used for studying the thermal decomp. of NH_4 divanadate, $(NH_4)_2V_4O_{11},3H_2O$ (I). At about 175° two mols. of H_2O are lost and the resulting monohydrate is completely converted at approx. 270° into anhyd. $(NH_4)_2V_6O_{11}$. Potentiometric titration of (I) with 0·15N aq. NH_3, using a H_2 electrode, shows that (I) contains two acidic H atoms. The formula of the salt may therefore be written $NH_4HV_2O_6,H_2O$. W. R. A.

Action of nitric oxide on thiosulphate and sulphide. A. Kurtenacker and H. Löschner (Z. anorg. Chem., 1938, **238**, 335—349).—The reactions of NO with $Na_2S_2O_3$ and with Na_2S have been investigated. The findings differ from those of Dunnicliff *et al.* (A., 1931, 922) for $(NH_4)_2S_2O_3$ and $(NH_4)_2S$. With neutral $Na_2S_2O_3$ the main product is $[(NO)_2SO_3]''$ (I), and S_3O_6'' and S_4O_6'' are also formed in addition to SO_4'' and S. (I) arises from the addition of NO to SO_3'' present in accordance with the equilibrium $S_2O_3'' \rightleftharpoons S + SO_3''$, whilst the other products result from the reactions $2S_2O_3'' + 2NO + H_2O = S_4O_6'' + N_2O + 2OH'$; $4S_4O_6'' + 6OH' = 2S_3O_6'' + 5S_2O_3'' + 3H_2O$ and $S_3O_6'' + 2OH' = S_2O_3'' + SO_4'' + H_2O$. In alkaline solution the polythionate ions are completely converted into S_2O_3'' and SO_3'', so that the whole reaction is $S_2O_3'' + 8NO + 2OH' = 2[(NO)_2SO_3]'' + 2N_2O + H_2O$. With Na_2S in excess the products are S_2O_3'' and N_2O as found by Dunnicliff *et al.* (*loc. cit.*) but with dil. Na_2S and excess of NO the reactions are $S'' + 2NO + H_2O = S + N_2O + 2OH'$ and $S + 6NO + 2OH' = [(NO)_2SO_3]'' + 2N_2O + H_2O$. The formation of S_2O_3'' in presence of excess of Na_2S results from $S'' + [(NO)_2SO_3]'' + H_2O = S_2O_3'' + N_2O + 2OH'$. F. J. G.

Preparation of thionyl bromide. F. Govaert and M. Hansens (Natuurwetensch. Tijds., 1938, **20**, 77—79).—A quant. yield of $SOBr_2$, m.p. −49·5°, b.p. 42·5°/16 mm., d^{20} 2·685, is obtained by adding $SOCl_2$ slowly to liquid HBr at −80°. S. C.

Chromic acids. S. Vigdorov and S. Taratzujan (J. Appl. Chem. Russ., 1938, **11**, 719).—

Treadwell's statement that aq. CrO_3 contains $H_2Cr_2O_7$, but not H_2CrO_4, is contradicted. The equilibrium $2H_2CrO_4 \rightleftharpoons H_2Cr_2O_7 + H_2O$ is shown to exist, being displaced to the left with increasing dilution. R. T.

Formation of molybdenum-blue. R. RINNE (Z. anal. Chem., 1938, **113**, 241—247).—The influence of the ratio $[H_2SO_4]$: $[NH_4$ molybdate] on the conditions of formation and colour of Mo-blue has been investigated. A good blue is obtained only within certain limits. The chemical identity of Mo-blue is questioned. E. S. H.

Cyanic and sulphuric acids.—See A., 1938, II, 352.

Mutual displacement of metals from the vapours of their salts and the application of this process in the fight against corrosion. N. A. ZVJAGINTZEV and E. S. SARKISOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 437—440).—Specimens of Armco Fe and of Cr were placed adjacent to one another in a tube furnace and heated in dry HCl at 875—1100°. The $CrCl_3$ formed was decomposed on the Fe, forming lustrous Cr coatings of controllable thickness, which were resistant to aq. NaCl, moist SO_2 + air, moist $H_2S + CO_2$ + air, N-HNO_3, and N-AcOH. With N-H_2SO_4 there was a small evolution of H_2. With a similar technique, W gives lustrous coatings on Fe, and Ni grey crumbly deposits. Deposition of Ni and Cr together gave lustrous durable coatings. H. J. E.

***X*-Ray investigation of the mechanisms of oxidation of iron and reduction of iron oxides.** K. ENDÔ (Sci. Rep. Tôhoku, 1938, **26**, 562—591).—The at. arrangements in crystals, brought about by the progressive oxidations $Fe \rightarrow FeO \rightarrow Fe_3O_4 \rightarrow Fe_2O_3$ and the reductions of these oxides, have been investigated. The process of reduction is exactly the inverse of that of oxidation; the expansion and contraction caused by the absorption and elimination of O are accompanied by at. displacements, and the resulting changes of at. arrangement are reversible. Changes of position of Fe atoms are recorded, as follows: (*a*) $Fe \rightleftarrows FeO$: in reduction Fe atoms in the plane (III) of FeO compose (110) or (111) of Fe; in oxidation, (110) of Fe becomes (111) of FeO. (*b*) $FeO \rightleftarrows Fe_3O_4$: some atoms in the plane (111) of the cubic lattice are slightly displaced in either direction. (*c*) $Fe_3O_4 \rightleftarrows Fe_2O_3$: (111) of both lattices are parallel. If rotation about the axis (111) be neglected, some Fe atoms in (111) are slightly displaced in either direction by contraction or expansion; one lattice transforms into the other. The change of position of the O atoms is as follows: (*a*) $Fe \rightleftarrows FeO$: in oxidation, O atoms enter the widest lattice of Fe atoms forming a face-centred cubic lattice; in reduction they emerge from the crystal lattice. (*b*) $FeO \rightleftarrows Fe_3O_4$: no change occurs. (*c*) $Fe_3O_4 \rightleftarrows Fe_2O_3$: if rotation be neglected, change takes place by subtraction or addition of some of the O atoms in plane (111) and displacement of these atoms in the same plane. C. M. A.

Spontaneous evolution of the magnetic properties of ferric hydroxide. R. CHEVALLIER and (MLLE.) S. MATHIEU (Compt. rend., 1938, **206**, 1955—1958).—The spontaneous transition of moist $Fe(OH)_3$ to either α-Fe_2O_3 or to gœthite (α-Fe_2O_3,H_2O) has been studied by magnetic measurements at various times after pptn. and with variations in [Fe‴] and [OH′]. For the first 2 hr. the susceptibility increases regularly; thereafter a more rapid increase with time takes place until a max. val. is obtained at about 20—30 hr.; a decrease then occurs. The total susceptibility (χ) is the sum of the initial χ_0 and a time variable χ_1. Variation of [Fe‴] or [OH′] has little effect on χ_0; χ_1, however, is considerably influenced by [OH′] but uninfluenced by [Fe‴]. A relationship between the magnetic properties of moist and dry $Fe(OH)_3$ of equal age and at identical [OH′] has been found. W. R. A.

Amorphous and crystallised oxide-hydrates and oxides. XLIV. Transformation of röntgenographically amorphous ferric hydroxide into γ-Fe_2O_3. A. KRAUSE and S. GAWRYCH (Z. anorg. Chem., 1938, **238**, 406—412).—The ferromagnetic "polyorthohydroxide" (I) (A., 1937, I, 196) which results when ordinary amorphous $Fe(OH)_3$ is treated with boiling N-NaOH is transformed into γ-Fe_2O_3 by heating under H_2O at 150° in an autoclave. On longer heating α-Fe_2O_3 results. It is suggested that (I) is the amorphous member of the γ-series. F. J. G.

Interaction of ferrous hydroxide and metallic hydroxides in ammoniacal solution. V. RODT (Angew. Chem., 1938, **51**, 526—528).—With FeO in excess, Ag_2O, Cu_2O, and PbO form hydrated Fe_3O_4 and, respectively, Ag, Cu, and Pb. With the metallic oxide in excess, hydrated Fe_2O_3 and Ag, Cu, or Pb are formed. C. R. H.

Action of hydrogen on iron and chromium carbides. L. JACQUÉ (Compt. rend., 1938, **206**, 1900—1902).—Slight decomp. of Fe_3C by H_2 at atm. pressure occurs in 20 hr. at 600°. At 500—550° and 50 kg. per sq. cm. pressure considerable decomp. occurs in 50 hr., and at 550° and 100 kg. per sq. cm. the residue contains only traces of C after this period. Cr_3C_2 and Cr_7C_3 (or Cr_5C_2) are unchanged by similar treatment. A. J. E. W.

Corrosion of iron and steel.—See B., 1938, 920, 921.

Ni^{II} salts of acyloinoximes and oximinoketones.—See A., 1938, II, 367.

Accuracy and reproducibility of spectroanalytical determinations. R. BRECKPOT (Natuurwetensch. Tijds., 1938, **20**, 86—90).—The various factors affecting the accuracy and reproducibility of spectra used for analytical purposes are discussed. S. C.

Effect of the background on intensity determinations in spectral analysis. C. WEYN (Natuurwetensch. Tijds., 1938, **20**, 90—91).—For a given type of photographic plate, the difference in blackening between a spectral line and the background is const. S. C.

Riptographic analysis. I. C. TOFFOLI (Gazzetta, 1938, **68**, 277—287).—The term "riptographic analysis" is proposed as a general name for methods of

analysis in which small portions of a reagent, capable of pptg. one or more mol. or ionic species from a solution are added gradually to the solution. After each addition of the reagent the sample is shaken and some suitable physical or chemical property of the clear solution is measured. The vals. of this property are plotted as ordinates against the amounts of the reagent added. The resulting graphs are then used in the analysis of the original solution. Preliminary results and advantages of the method are described. O. J. W.

Mixed indicator to replace methyl-orange. K. HÖPPNER (Deut. Zuckerind., 1936, **41**, 361—362; Chem. Zentr., 1936, ii, 1765).—The indicator contains 4 parts of a 0·2% EtOH solution of bromocresol-green and 1 part of a similar solution of dimethyl-yellow, and can be used in the titration of alkali carbonates and H carbonates, as well as for the determination of the soda no. of boiler feed H_2O. The colour change is blue (alkaline) to green to yellow (acid); the change green → yellow is sharp at p_H 4·2—4·7. L. S. T.

Quininic acid as a fluorescence indicator. L. SZEBELLÉDY and J. JÓNÁS (Z. anal. Chem., 1938, **113**, 266—275).—The fluorescent properties of quinine which has been oxidised by aq. Br are identical with those of quininic acid. In ultra-violet light, alkaline solutions show a blue and acid solutions a yellow fluorescence. The interval of the colour change occurs at p_H 4·0—5·0. Quininic acid can be used as an indicator with strong acids and with strong or weak bases, and is applicable in the case of highly-coloured solutions. E. S. H.

Determination of moisture. C. W. GRIFFITHS (Ind. Eng. Chem. [Anal.], 1938, **10**, 394).—The apparatus described helps in reading the vol. of the aq. distillate and eliminates errors due to parallax in the Dean–Stark method. L. S. T.

Colorimetric standards for the *o*-tolidine method for determining chlorine in water.—See B., 1938, 389.

Rôle of osmium tetroxide in the activation of chlorate. H. VOGELS (Cong. Chim. ind. Bruxelles, 1935, **15**, II, 1062—1067; Chem. Zentr., 1936, ii, 1392).—ClO_3' can be determined volumetrically or electrometrically by reaction with Na_3AsO_3 in presence of excess of H_2SO_4 with OsO_4 as catalyst. The redox system ClO_3'–OsO_4 has been investigated electrometrically with special reference to the effect of p_H and [Cl']. With 0·1N solutions of ClO_3' acidified to N with H_2SO_4 or $HClO_4$, containing 3 drops of 2·5% OsO_4 solution, and titrated with 1N-acid solutions of 0·1N-As_2O_3, a p.d. of 770 mv. at 2° and 220 mv. at 52° is obtained. For the volumetric method As_2O_3 solution in excess is added slowly to the mixture of ClO_3', OsO_4, and acid, and after neutralisation with $NaHCO_3$, the excess of As_2O_3 is titrated with I. The two methods agree to approx. 0·1%. ClO_3' can be determined in presence of ClO_4'. $OsO_3(ClO_3)_2$ is assumed to be formed as an intermediate product in the above method. L. S. T.

Determination of small amounts of bromide and iodide in presence of chloride. S. SACCONI (Annali Chim. Appl., 1938, **28**, 223—227).—Br' is oxidised by $KMnO_4$–H_2SO_4 and the liberated Br distilled into aq. KI which is finally titrated with 0·1N- or 0·01N-$Na_2S_2O_3$. When I' is present, it is removed (for subsequent determination) by treatment with HNO_2 and extraction with $CHCl_3$, excess of HNO_2 being decomposed by $CO(NH_2)_2$ before determining Br'. F. O. H.

Determination of bromine in salt solutions. M. J. SCHAPIRO (Hydro-Chem. Mat., 1938, **10**, 277—286).—The reactions $KMnO_4 + 2KBr + 2HCN + 2H_3PO_4 = 2BrCN + K_2PO_4 + MnPO_4 + 4H_2O$ and $BrCN + 2KI = 2I + KBr + KCN$ are used. J. J. B.

Determination of iodides in complex mixtures. J. B. FULLERTON, W. J. WATKINS, and C. L. GRAHAM (J. Amer. Pharm. Assoc., 1938, **27**, 417—419).—The prep. (equiv. to 5 grains of KI) in 50 c.c. of dil. H_3PO_4 is treated with H_2O_2 and the liberated I extracted with $CHCl_3$. The $CHCl_3$ extract is treated with 4 g. of KI in 25 c.c. of H_2O and titrated with 0·1N-$Na_2S_2O_3$, using starch as indicator. The application of the method to pharmaceutical preps. (including I ointment, U.S.P.) is described. F. O. H.

Determination of fluorine spray residue on tomatoes.—See B., 1938, 973.

Analysis of fluorine products.—See B., 1938, 904.

Preparation and application of chromous solutions for the absorption of oxygen in volumetric gas analysis. J. R. BRANHAM (J. Res. Nat. Bur. Stand., 1938, **21**, 45—61).—Although the reaction between acidified or non-acidified solutions of $CrCl_2$ or $CrSO_4$ and O_2 is complete, the former salt is recommended. Acidified solutions of $CrSO_4$ liberate H_2S which reacts with Hg in the apparatus, whilst the error due to the liberation of H_2 from acidified solutions of $CrCl_2$ is of the same order of magnitude as that due to the liberation of CO_2 from alkaline solutions of pyrogallol (I). A comparison of acidified $CrCl_2$ and alkaline (I) as reagents for gas absorption suggests that any advantage of one over the other is too small to warrant an experimenter changing from that reagent with which he is familiar. C. R. H.

[Rapid] determination of sulphur in steels.—See B., 1938, 920.

Determination of sulphur in oil.—See B., 1938, 872.

Determination of sulphur in coal and coke.—See B., 1938, 865.

Determination of hydrogen sulphide and hydrogen cyanide in gases.—See B., 1938, 868.

Simplified colorimetric determination of sulphur dioxide in air. S. M. TSCHUMANOV and M. B. AXELROD (J. Appl. Chem. Russ., 1938, **11**, 720).—The air is passed through a Fe^{III} solution containing $K_3Fe(CN)_6$, and the $[SO_2]$ is derived from the intensity of the resulting blue or green coloration. R. T.

Determination of free sulphuric acid in presence of salts of iron. N. D. PODOBED (J. Appl. Chem. Russ., 1938, **11**, 701—703).—The solution is

titrated with NaOH, taking the appearance of turbidity as the end-point. R. T.

Determination of sulphuric acid and sulphur dioxide in flue gases.—See B., 1938, 903.

Accuracy of determination of the concentration of solutions of thiosulphate in aqueous organic solvents. L. FILIPCZYK (Rocz. Chem., 1938, **18**, 139—144).—The vol. of standard I solution used for titration of solutions of $Na_2S_2O_3$ in aq. org. solvents ($COMe_2$, MeOH, glycerol) rises with increasing concn. of org. solvent. An empirical correction, determined by titrating $Na_2S_2O_3$ solutions of known concn., in presence of the same concns. of org. solvent as in the unknown, should be applied. R. T.

Transposition of silver thiocyanate by sodium chloride. H. R. CURTMAN and W. PRIMAK (Ind. Eng. Chem. [Anal.], 1938, **10**, 323—324).—Optimum conditions for the transposition of AgCNS by M-NaCl are the addition of 60 ml. of M-NaCl per 0·1 g. of CNS as AgCNS, and boiling the mixture for <5 min. Approx. 95% of the thiocyanate is converted into chloride. L. S. T.

[Determination of] selenium. A. L. CURL and R. A. OSBORN (J. Assoc. Off. Agric. Chem., 1938, **21**, 228—235; cf. A., 1937, I, 424).—A procedure for digestion with HNO_3–H_2SO_4–HgO is described. The volumetric determination with $Na_2S_2O_3$ and starch indicator is best carried out by adding excess of $Na_2S_2O_3$, titrating to a slight excess with I, and finally titrating with $Na_2S_2O_3$. The method is satisfactory with <5 μg. Se. E. C. S.

Reduction of selenious acid by thiocyanic acid. W. T. HALL (Ind. Eng. Chem. [Anal.], 1938, **10**, 395—396).—When KCNS is added to boiling 6N-HCl the HCNS formed is promptly decomposed, and the chief products are NH_4^+, H_2S, and CO_2; no HCN could be detected. In agreement with Ljung (A., 1937, I, 475) the reaction between HCNS and H_2SeO_3 varies at different [HCl] and temp. At the b.p., Se is soon pptd. The reaction detects very small amounts of Se, but is not recommended for quant. work. The scheme $2H_2SeO_3 + HCNS \rightarrow 2Se + CO_2 + SO_4'' + H^+ + NH_4^+$ indicates the reaction that occurs, but this seldom takes place in accordance with a single definite equation. Previous conclusions concerning the reaction are discussed. L. S. T.

Iodometric micro-determination of selenate in presence of selenite. H. A. PAGEL and J. C. MIERS (Ind. Eng. Chem. [Anal.], 1938, **10**, 334—335).—The Gooch–Evans procedure is unsatisfactory for mixtures containing a few mg. of SeO_4'' in presence of approx. 0·1 g. of SeO_3''. In the modified method described the SeO_4'' solution is made 5—6N with respect to HCl and heated at the b.p. while a current of CO_2 passed through the solution leads the evolved gases through a reflux condenser into aq. KI. The liberated I is titrated with 0·01—0·005N-$Na_2S_2O_3$. With [HCl] <7N positive errors due to the volatilisation of $SeCl_4$ occur. Comparatively large amounts of Na_2SO_4 are without effect. L. S. T.

Displacement of nitrogen from and its dissolution in certain reagents during volumetric gas analysis. J. R. BRANHAM and M. SUCHER (J. Res. Nat. Bur. Stand., 1938, **21**, 63—77).—Errors caused by dissolution and displacement of those components of a gas mixture which are inert towards the absorbent, *A*, have been investigated. The magnitude of the error is approx. ∝ the solubility of the inert gas in *A*, but depends also on the rate of absorption, the composition of *A*, the composition of the gas mixture, the form of the apparatus, and the procedure. A 1-in. layer of oil on *A* does not appreciably affect the passage of O_2 or N_2 through the open surface of *A*. C. R. H.

Determination of the gases in steel.—See B., 1938, 920.

Use of cerium chloride for precipitating small amounts of phosphorus.—See A., 1938, III, 774.

Determination of organic and mineral phosphorus in natural waters. S. V. BRUEVITSCH and A. A. KOSTROMINA (J. Appl. Chem. Russ., 1938, **11**, 682—690).—25 ml. of H_2O and 2 ml. of H_2SO_4 are subjected to Kjeldahl combustion, and total P is determined colorimetrically. H_2O-sol. and -insol. P, and org. and inorg. P are determined by the methods of Kalle (A., 1936, 1478). R. T.

Determination of phosphoric acid in the selenium catalytic decomposition.—See B., 1938, 965.

Analysis of phosphate rock.—See B., 1938, 904.

Determination of small amounts of phosphate by use of hydroxyquinoline.—See A., 1938, III, 774.

[Determination of] arsenic. C. C. CASSIL (J. Assoc. Off. Agric. Chem., 1938, **21**, 198—203; cf. A., 1937, II, 358).—Widely different results were obtained when $HClO_4$, H_2SO_4–HNO_3, and dry methods of ashing were employed. The first appears to be the most effective. In the Gutzeit method considerable variation was found in the Hg content of strips impregnated with $HgBr_2$, introducing another source of error into this method. A procedure is outlined for carrying out the I titration of AsH_3, satisfactory results being reported. A new rapid procedure for Zinzadze's Mo-blue method, which gives a depth of colour ∝ the As present, is described. E. C. S.

Argentometric determination of arsenic. I. SARUDI (Z. anal. Chem., 1938, **113**, 248—251).—AsO_4''' can be determined by pptn. with $AgNO_3$, drying the ppt. at 170—180°, and weighing as Ag_3AsO_4. Special directions are given for samples containing Cl'. E. S. H.

Cerate oxidimetry. Evaluation of solutions using sodium oxalate, arsenious acid, and iron as standards of reference, and ferroin and nitroferroin as indicators. G. F. SMITH and C. A. GETZ (Ind. Eng. Chem. [Anal.], 1938, **10**, 304—306).—The potentiometric titration of C_2O_4'' and AsO_3'' with "perchloratocerate" solutions (cf. A., 1938, I, 325) in aq. $HClO_4$ shows potential breaks of 650 and 600 mv., respectively. Nitroferroin (nitro-*o*-phenanthroline $Fe^{..}$ ion) (I) has a colour transition at the half-way interval (1·25 v.) of both potentiometric breaks. In the standardisation of "sulphatocerate" solution excess is added to a weighed quantity of

$Na_2C_2O_4$ in N-H_2SO_4, the solution is heated at 50° for 5 min., cooled, and titrated with $FeSO_4$ using ferroin as indicator. In the direct titration of AsO_3''' in 2N-$HClO_4$ with perchloratocerate solutions, osmic acid is used as catalyst and (I) as indicator; the method is preferable to that using sulphatocerate as oxidant in H_2SO_4 solution. $Na_2C_2O_4$, H_3AsO_3, and standard $FeSO_4$ solution (standardised indirectly against oxalate) give concordant results in evaluating perchlorato- or nitrato-cerate solutions. NH_4 or K hexanitratocerate or electrolytically-oxidised cerate solutions are satisfactory for the prep. of the oxidising solutions. L. S. T.

Determination of arsenic and copper [in insecticides].—See B., 1938, 961.

Detection of small amounts of arsenic. Determination of arsenic in wine.—See B., 1938, 965.

Chemical determination of quartz (free silica) in dusts. E. KAPLAN and W. T. FALES (Ind. Eng. Chem. [Anal.], 1938, **10**, 388).—An equation is given for calculating the amount of quartz originally present when the method of Knopf (U.S. Publ. Health Rep., 1933, **48**, 183) or Line and Aradine (A., 1937, 1, 198) is used. L. S. T.

Drop-colorimetric determination of silicic acid in limestone, dolomite, and cement.—See B., 1938, 904.

Diphenylcarbazone as mercurimetric indicator. Determination of thiocyanates and cyanides. J. TRTÍLEK (Coll. Czech. Chem. Comm., 1938, **10**, 242—248).—Thiocyanates and cyanides may be titrated with $Hg(NO_3)_2$ using an EtOH solution of diphenylcarbazone as indicator in presence of 0·5—5 c.c. of 0·2N-HNO_3. The formation of coloured metallic thiocyanates and cyanides precludes its use in certain cases. K. W. P.

Titration of the combined contents of potassium and sodium in potable waters.—See B., 1938, 990.

Spectrographic determination of small amounts of silver, arsenic, bismuth, copper, and antimony in lead.—See B., 1938, 923.

Determination of traces of silver in lead oxide.—See B., 1938, 904.

Precipitation of calcium in the presence of ammonium molybdate and iron. R. C. WILEY and A. YEDINAK (Ind. Eng. Chem. [Anal.], 1938, **10**, 322—323).—In the method detailed for the determination of Ca and PO_4''' in the same nutritional sample, the PO_4''' is removed and determined as NH_4 phosphomolybdate, and then the Ca is pptd. as oxalate and determined by means of $KMnO_4$. In presence of moderate amounts AcOH and $(NH_4)_2C_2O_4$, NH_4 molybdate does not interfere with the quant. pptn. of the Ca. Moderate amounts of Fe are also without effect on the results. L. S. T.

Electrode of the third kind with lead oxalate and the electrometric titration of calcium in presence of chlorides. E. DENINA (Gazzetta, 1938, **68**, 295—307).—The Pb–PbC_2O_4–CaC_2O_4 electrode is very satisfactory for the potentiometric titration of $Ca^{"}$ in presence of chlorides. A dil. Pb amalgam electrode is the most stable and gives the greatest sensitivity. O. J. W.

[Determination of] zinc. R. A. CAUGHEM, E. B. HOLLAND, and W. S. RITCHIE (J. Assoc. Off. Agric. Chem., 1938, **21**, 204—207; cf. *ibid.*, 71).—A procedure giving a satisfactory separation of Zn from other metals, using diphenylthiocarbazone, is described. E. C. S.

Gravimetric determination of zinc by the mercuric thiocyanate method. W. C. VOSBURGH, G. COOPER, W. J. CLAYTON, and H. PFANN (Ind. Eng. Chem. [Anal.], 1938, **10**, 393—394).—The change in wt. of a ppt. of $ZnHg(CNS)_4$ washed with 0·001M-$K_2Hg(CNS)_4$ at 5—10° is negligible; washing at 20—30° results in appreciable loss. Pptn. should be effected first by seeding the solution, and then by addition of the 0·1M-reagent at a rate of approx. 2·5 ml. per min. with mechanical stirring. The 0·1M-reagent should be prepared with a 10—17% excess of CNS′, and for 0·03 g. of Zn in 100 ml. up to 45 ml. is not harmful. The ppt. is allowed to digest in the mother-liquor at room temp. for <1 hr. 5 g. of H_2SO_4 or 2·5 g. of HNO_3 per 100 ml. can be present, but the amounts of KCl and NH_4 salts permissible are much less. For amounts of Zn up to 0·05 g., the method is accurate to 0·3%. L. S. T.

Colorimetric micro-determination of zinc. W. L. LOTT (Ind. Eng. Chem. [Anal.], 1938, **10**, 335—338).—A procedure for the determination of Zn (0·05 to 2 mg.) in soils is described. The Zn is separated from interfering elements as ZnS, dissolved in the min. amount of HCl, and then pptd. by means of 5-nitroquinaldic acid (I) in a solution acidified with AcOH. Dissolution of the ppt. in $SnCl_2$ + HCl gives an orange-coloured solution suitable for photo-electric comparison. The intensity of the colour of the reduction product is independent of acid concns. $>0·8$N and of $[SnCl_2]$ between 0·075 and 0·40% $SnCl_2,2H_2O$, but increases with a rise in temp. The colour is stable for <24 hr. Pptn. of Zn by (I) is complete between p_H 2·5 and 8·0 after digestion (water-bath) for 30 min. NH_4Cl and NaCl in concns. $>0·7$N inhibit complete pptn. Adsorption of excess of (I) is negligible. Ag, Pb, Hg, Cu, Fe, Mn, Co, and Ni are pptd. by (I) from slightly acid solutions and must be absent. L. S. T.

Quantitative separation of metals by hydrogen sulphide. I. Separation of zinc from nickel. II. Separation of zinc from cobalt. Mechanism of precipitation of nickel and cobalt sulphides. H. KATÔ (Sci. Rep. Tôhoku, 1938, **26**, 714—732, 733—742).—I. Zn may be pptd. completely with H_2S if the final p_H is >1, irrespective of the initial p_H. NiS is completely pptd. if the initial p_H is >3; it can also be pptd. if the initial p_H is $<2·5$ by heating and by addition of an inducer. For the separation of Zn from Ni, the p_H of the solution must be 2·4, a buffer is necessary to neutralise the strong acid liberated by ZnS pptn., and precautions must be taken to prevent induced pptn. of NiS. Various methods of separation are examined and criticised, and p_H diagrams of various acids and

buffers are given. The results are compared with those obtained by Haring and Westfall (A., 1931, 325; see also A., 1932, 1011; 1933, 478).

II. Pptn. of CoS takes place at p_H >2·7 and is accelerated by heat and inducer (CoS) even at p_H 1·2—2·7. Co is completely pptd. with H_2S in a buffer solution of p_H 3, and incomplete pptn. sometimes takes place in an unbuffered solution of p_H 4. The pptn. of CoS may be normal or induced. The latter consists of the pptn. of unstable modifications at p_H <3·1 and 2·7, respectively. These are subsequently stabilised. The velocity of induced pptn. decreases with the p_H, becoming zero at p_H 1·3—1·2. The separation of Zn from Co is similar to that of Zn from Ni, the " separation p_H " in this case being 2·3.

C. M. A.

Importance of hydrogen-ion concentration for the determination and separation of metals by anthranilic acid. H. Gotô (Sci. Rep. Tôhoku, 1938, **26**, 677—686).—The ranges of p_H for complete pptn. are: Zn, 4·72—3·76; Cd, 5·32—4·25; Ni, 4·51—3·64; Co, 4·41—3·36; Cu, 2·79—1·40; Mn, 5·15—4·10. Pptn. curves show the feasibility of determination and separation of metals by this method. C. M. A.

Elimination of errors of potentiometric titration. II. A. B. Schachkeldian (J. Appl. Chem. Russ., 1938, **11**, 691—696).—The amount x of an ion is given by $x = a(x + c)/A$, where a is the result of electro-titration of the solution, and A that of titration of the same solution + a known amount c of the same ion. The method is verified in the case of titration of $Cd^{"}$ with standard $K_4Fe(CN)_6$; the results are independent of the [Cd], of the solubility product of the ppt., and of other factors. R. T.

Application of selective reactions to the detection of poisonous metals. E. Ivanoff (J. Pharm. Belg., 1936, **18**, 59—62, 79—82; Chem. Zentr., 1936, ii, 1397—1398).—A scheme for the preliminary separation of these metals into groups and confirmation mainly by means of the org. reagents now in use for drop reactions is given. L. S. T.

***X*-Ray image method of chemical analysis.** L. von Hámos (Amer. Min., 1938, **23**, 215—226; cf. A., 1934, 383, 980).—The general features of this method are described. Image spectra for bornite, cobaltite, chromite, franklinite, ores containing Fe and Zn, and Mn and Fe, and two alloys (Co + Ni and Cu + Ni + Zn) are reproduced. L. S. T.

Micro-determination of lead by means of electrolysis and dithizone. H. Müller (Z. anal. Chem., 1938, **113**, 161—182).—The dithizone method for determining Pb has been critically investigated. Examination of various factors such as sensitiveness of the reagent towards oxidising agents, and the action of light, the difficulty of complete extraction of the Pb, the effect of p_H, possible losses in washing with aq. NH_3 and aq. KCN, and the marked interferences due to the presence of cations such as Bi, Zn, Sn, and Tl, reveals the possibility of introducing serious errors into the determination. A procedure designed to avoid these errors as far as possible is described for the determination of Pb in absence of Bi, Sn, Tl, and large amounts of Zn. Data showing the effect of acid concn., stirring, N oxides, etc. on the electrolytic method (A., 1935, 720) are also recorded and discussed. Cl' and PO_4''' must be absent, but, except in the case of large amounts of Bi, interference by cations is not serious. Details of a suitable procedure are given. When the colorimetric comparison using " tetrabase " is supplemented by an iodometric titration the electrolytic method extends from 5 to 5000 μg. Pb. The relative merits of the two methods are compared, and for the determination of Pb in biological material, at least, the electrolytic method is preferred.

L. S. T.

Electrographic determination of lead in lead–tin alloys.—See B., 1938, 924.

Simple gravimetric determination of copper. P. Hersch (Analyst, 1938, **63**, 486—487).—Fehling's solution in contact with Ag, Ag solder, silvered glass, Ni, Pt, etc. reacts with CH_2O to give a deposit of Cu which adheres to the catalyst and also maintains the catalytic activity. The neutral Cu solution is treated with K Na tartrate, NaOH, and CH_2O in a Pt dish and the Cu is deposited gradually, the H_2 evolved simultaneously acting as a stirrer. When quite colourless the solution is merely poured out. The average error was −0·1%. T. H. G.

[Determination of] mercury. W. O. Winkler (J. Assoc. Off. Agric. Chem., 1938, **21**, 220—228).—Procedures are described for concn. of Hg in HNO_3 extracts by pptn. with Zn, for rapid isolation of the Hg, and for its determination with diphenylthiocarbazone. Preliminary work on a photometric method is reported. E. C. S.

[Macro-, semi-micro-, and micro-]determination of mercury in inorganic and organic compounds and pharmaceutical preparations. W. H. Rauscher (Ind. Eng. Chem. [Anal.], 1938, **10**, 331—333).—For salts, oxides, mercurochrome, and pharmaceuticals containing such compounds the solid sample is heated with $NH_2{\cdot}[CH_2]_2{\cdot}OH$ (I) for 5 min., thereby forming metallic Hg which is either collected and weighed on a Pregl halogen tube or is dissolved in HNO_3 and titrated with 0·02—0·05N-CNS′ solution. Compounds which do not readily respond to this method of attack can be treated with (I), dioxan, and Na (cf. A., 1937, II, 358). Substitution of $NH(C_2H_4{\cdot}OH)_2$ for (I) in the first method and refluxing for 30 min. gives a quant. reduction of certain org. Hg types. Halogens can be determined simultaneously and the methods can be used for detection of Hg. L. S. T.

Electrometric determination of rare earths as oxalate. J. A. Atanasiu (Z. anal. Chem., 1938, **113**, 276—279).—$CeCl_3$, $Ce(NO_3)_3$, $LaCl_3$, or $La(NO_3)_3$ in 50% EtOH–H_2O at 70° can be titrated with K, Na, or NH_4 oxalate. $Th(NO_3)_4$ can be titrated under the same conditions in H_2O. In mixtures of the above salts, only the sum of the elements can be determined by the procedure described. E. S. H.

Preparation of ammonium aurintricarboxylate. J. A. Scherrer and W. H. Smith (J. Res. Nat. Bur. Stand., 1938, **21**, 113—115).—The following

method gives a product suitable for the colorimetric determination of Al. To 44 ml. of H_2SO_4 (*d* 1·84) are gradually added 4 g. of $NaNO_2$, and the solution is cooled to 10°. 12 g. of *o*-$OH{\cdot}C_6H_4{\cdot}CO_2H$ are then gradually added followed by 3·5 ml. of a 37% solution of CH_2O, the solution being kept at 5°. The mixture is kept in ice for 1 hr. with frequent stirring, and is then allowed to attain room temp. over a period of 20 hr. It is next poured into 2 l. of cold distilled H_2O, kept for 1 hr., filtered, and the washed ppt. boiled with dil. HCl. After further washing and boiling with HCl the residue is dissolved in excess of aq. NH_3 and evaporated to dryness on a steam-bath. C. R. H.

Rapid test for distinguishing the different aluminium alloys.—See B., 1938, 928.

Detection of manganese atoms of various valencies in minerals. J. HOFFMANN (Z. anorg. Chem., 1938, **238**, 385—394).—The applicability of certain reactions of Mn to the determination of the valency of Mn in minerals is discussed. F. J. G.

Determination of manganese, chromium, and vanadium in presence of each other.—See B., 1938, 919.

Complete removal of ferric chloride from solution by continuous extraction with ether. S. E. Q. ASHLEY and W. M. MURRAY, jun. (Ind. Eng. Chem. [Anal.], 1938, **10**, 367—368).—A solution from a 10-g. sample of Fe, freed from insol. material, is converted into $FeCl_3$, evaporated to dryness, transferred to specially-constructed apparatus with 100 ml. of 8—9N-HCl, and boiled with 200 ml. of Pr^{β}_2O. The condensate is returned to the bottom of the extraction tube by an inserted funnel, whilst droplets make their way to the surface of the $FeCl_3$ solution, and, saturated with $FeCl_3$, overflow through a side-arm into a conical flask. Extraction is complete in 16 hr. The process is carried out in darkness or in dim artificial light. Economy in the amount of Pr^{β}_2O is effected. L. S. T.

Use of thioglycollic acid in quantitative analysis. C. MAYR and A. GEBAUER (Z. anal. Chem., 1938, **113**, 189—211).—The formula $CH_2<^{S}_{CO\cdot O}>Fe$ for the yellow ppt. formed in a slightly acid solution with $SH{\cdot}CH_2{\cdot}CO_2H$ (I) and $Fe^{\cdot\cdot}$ is confirmed (cf. A., 1932, 1235). The red colour obtained with an excess of alkali is due to the complex $Fe(S{\cdot}CH_2{\cdot}CO_2Na)_2$ or $Fe(S{\cdot}CH_2{\cdot}CO_2NH_4)_2$. The stability of these H_2O-sol. complexes permits a quant. separation of $Fe^{\cdot\cdot}$ from Al, Ca, Mg, or Ti. In all the separations given Fe is first reduced by means of SO_2 and then kept in solution as the complex by the addition of (I) and aq. NH_3. Al is pptd. as Al_2O_3,nH_2O, Ti as TiO_2,nH_2O, Ca as CaC_2O_4 followed by conversion into $CaSO_4$, and Mg as $MgNH_4PO_4,6H_2O$ or $MgCO_3,(NH_4)_2CO_3,4H_2O$ as in Schaffgotsch's method. The complex is oxidised by treatment with H_2O_2, which ppts. the Fe as hydroxide, and the Fe is weighed as Fe_2O_3. Owing to the formation of similar complexes, separation from Ni, Cr, and Zn cannot be effected. Applications to the analysis of calcite, magnesite, and Ti minerals are described, and, for the last-named, data showing comparison with the Schwarz von Bergkampf method are given for ilmenite and rutile. The iodometric and acidimetric methods for the determination of (I) have been critically examined. Exclusion of atm. O_2 is essential for accurate results. L. S. T.

Determination of ferric oxide and sulphide-sulphur in basic slags.—See B., 1938, 915.

Detection of cobalt, copper, and ferrous iron with 2-nitroso-α-naphthol-4-sulphonic acid. L. A. SARVER (Ind. Eng. Chem. [Anal.], 1938, **10**, 378; A., 1885, 545).—A 1% aq. solution of the dye, which is stable in H_2O for several months, gives red, orange, and green colours with $Co^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, and $Fe^{\cdot\cdot}$, respectively. In conc. solutions, ppts. are formed. Optimum p_H vals. are 5 for $Fe^{\cdot\cdot}$, and 7—8 for $Co^{\cdot\cdot}$. $Fe^{\cdot\cdot\cdot}$ gives a weaker colour reaction, but this can be suppressed by the addition of F′. High $[Ni^{\cdot\cdot}]$ interferes, but Co can be detected in presence of 1000 times as much Ni. $Cr^{\cdot\cdot\cdot}$ and other common ions do not interfere. CN′ prohibits the reaction. The sensitivity of the reaction is ~1 in 2×10^7 and approx. 0·01 μg. of $Co^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, or $Fe^{\cdot\cdot}$ can be detected as a "spot" test. L. S. T.

[Electrolytic] determination of small amounts of nickel, cobalt, and copper in ores.—See B., 1938, 923.

Determination of nickel in alloy steels. Photometric titrimeter.—See B., 1938, 919.

Rapid determination of chromium in complex steels.—See B., 1938, 919.

Importance of hydrogen-ion concentration for the determination of molybdenum and vanadium by the oxine method. Solubility of oxine in various solvents. H. GOTÔ (Sci. Rep. Tôhoku, 1938, **26**, 418—428).—p_H ranges for complete pptn. and the limits beyond which pptn. ceases have been ascertained in the gravimetric determination of Mo and V by the oxine method. Mo was completely pptd. at p_H 3·3—7·6 and not at all at p_H <0·7 or >13·1. V was completely pptd. at p_H 2·7—6·1 and not at all at p_H <1·1 or >7·3. The solubility of oxine in aq. EtOH and $COMe_2$ solutions of various p_H was also determined. The solubility is small at p_H 5·5 to 5·8 but increases rapidly on addition of EtOH and $COMe_2$. C. M. A.

Determination of molybdenum in ferrous alloys.—See B., 1938, 920.

Oxidimetric determination of tungstates. F. VLASÁK (Coll. Czech. Chem. Comm., 1938, **10**, 278—289).—HCl solutions of Na_2WO_4, obtained from aq. solution by rapid addition of the acid to prevent formation of the insol. monohydrate, are reduced quantitatively from W^{VI} to W^{III} by Pb amalgam, at 50°, in an inert atm. Appropriate indicators for the subsequent quant. oxidation with 0·1N-$CuSO_4$, -$KBrO_3$, or -$K_2Cr_2O_7$ have been found by potentiometric titration. $K_2Cr_2O_7$ with $NHPh_2$ is best. K. W. P.

Spectral analysis of tin. R. BRECKPOT and J. EECKHOUT (Natuurwetensch. Tijds., 1938, **20**, 92—95).—The optimum conditions for the spectral analysis of Sn using metal/metal or metal/graphite,

arc: arc length 2 mm., 1·2 amp., exposure after 25 sec., time and slit width const. Excellent reproducibility is obtained under these conditions. S. C.

Bromometry. II. Determination of tin, phosphorous acid, and thiosulphuric acid. T. NAKAZONO (Sci. Rep. Tôhoku, 1938, **26**, 743—748; cf. A., 1938, I, 211).—In the titration of $SnCl_2$ with $KBrO_3$ the [HCl] should be about 0·4—0·6N. H_3PO_3 can be determined potentiometrically with Br in presence of NaOAc or $NaHCO_3$. In the titration of S_2O_3'' a sample solution should be added to a standard solution of Br and NaOH; $Na_2S_2O_3 \equiv 8Br$. The results are compared with those obtained by iodometry and by the indicator method. C. M. A.

Spectral analysis of niobium and tantalum. J. CREFFIER (Natuurwetensch. Tijds., 1938, **20**, 63).—Optimum conditions (2 amp., 65—70 v., 30 sec. exposure with oxide on cathode) are described for the spectrophotographic determination of Nb and Ta to an accuracy of 1·5% using a Hilger F_D 60 spectrograph. S. C.

Determination of niobium and tantalum in stainless steel.—See B., 1938, 920.

Drop reagent for detection of gold. L. ROSSI (Quim. e Ind., 1935, **12**, 277—278; Chem. Zentr., 1936, ii, 513).—A reagent consisting of 5 c.c. of 1% narcotine in conc. H_2SO_4 + 5 c.c. of 10% $SnCl_2$ + 5 c.c. of 10% $FeSO_4$ gives a very sensitive blue to reddish-violet spot on filter-paper with solutions containing Au. $Pt^{''''}$ gives a yellow spot and $MoO^{''}$ gives a blue colour which is destroyed by H_2O_2. H. J. E.

Colorimetric determination of gold in dilute solutions, using α-naphthylamine hydrochloride. I. A. PAULSEN and S. M. PEVZNER (J. Appl. Chem. Russ., 1938, **11**, 697—700).—1 ml. of 0·1% α-$C_{10}H_7{\cdot}NH_2$,HCl is added to 1 ml. of the solution, containing $\leqslant 1$ μg. of Au, H_2O is added to 10 ml., and the coloration is compared with that given by standard Au solution. Pd interferes, but not Fe, Cu, Pb, or Zn. R. T.

Micro-titration of platinum in presence of other platinum metals. W. B. POLLARD (Bull. Inst. Min. Met., 1938, No. 406, 11 pp.).—Substitution of bromides for chlorides in the method described previously (B., 1938, 389, 799) eliminates the interference due to Pd, which is pptd. as metal by the $SnBr_2$. The effects on the method of the small amounts of base metals that may be present in the cupellation beads are recorded. The procedure for determining Pt from these beads when all the Pt metals and Au are present is detailed. A solution in C_6H_6 of the compound containing Br, Pt, and diethyldithiocarbamate changes in colour from orange to olive-green in direct sunlight and to orange again in diffused light; this provides a characteristic reaction for Pt. A test for Rh with $SnBr_2$ in HBr solution is also described. L. S. T.

Gravimetric determination of palladium. (MISS) R. SCHÖNTAL (J.C.S., 1938, 1099—1100).—To the cold Pd solution, 0·1N with respect to HCl, is added an excess of a solution of p-$NH_2{\cdot}C_6H_4{\cdot}COMe$ (1 g. in 100 c.c. of H_2O containing 2 c.c. of conc. HCl). After shaking, the yellow ppt. of $(NH_2{\cdot}C_6H_4{\cdot}COMe)_2,PdCl_2$ is collected, washed with cold H_2O, and either dried at 80° to const. wt. or ignited to Pd. If present, Ce must be removed, and considerable dilution is necessary in presence of Pt. C. R. H.

"Long burner" adapter for Bunsen burners. A. KNOLL and J. SCHUKAL (Ind. Eng. Chem. [Anal.], 1938, **10**, 348). L. S. T.

Laboratory "gadgets." P. H. FAWCETT (Drugs, Oils, and Paints, 1938, **53**, 209—210).—Instructions are given for the improvisation of laboratory apparatus when the usual types are not available. Apparatus described includes a time switch for controlling gas or electric heaters, a hygrometer, a centrifuge, a const.-temp. oven, and numerous small devices such as gas lighters, burette clamps, etc. D. R. D.

Self-regulating resistance. M. A. FOEX (Document. Sci., 1936, **5**, 71—76; Chem. Zentr., 1936, ii, 338).—A clockwork device for continuous alteration of resistances for cooling-curve furnaces is described. H. J. E.

Automatic cooling device for thyratron-controlled thermostats. A. B. GARRETT (Ind. Eng. Chem. [Anal.], 1938, **10**, 324).—Adaptation of the thyratron control unit to automatic cooling is outlined. L. S. T.

Two accurate thermoregulators. K. VAN NES and A. TJEPKEMA (Chem. Weekblad, 1938, **35**, 534—535).—The regulator fluid is contained in a spiral tube and control is effected electrically with Hg–Pt contacts in a capillary. A regulator for circulating liquids gives a max. variation of 0·001°. A non-circulating Hg-in-glass regulator gives a max. variation of 0·005° for temp. $\gtrsim 200°$. S. C.

Thermal conductivity of liquids. Binary mixtures of water–methyl alcohol and water–ethyl alcohol. O. K. BATES, G. HAZZARD, and G. PALMER (Ind. Eng. Chem. [Anal.], 1938, **10**, 314—318).—Improvements in the operation of the apparatus previously described (A., 1936, 674) are outlined, and results of determinations of the thermal conductivity and temp. coeffs. of thermal conductivity of the above mixtures are recorded. L. S. T.

Production and measurement of low temperatures. K. R. DIXIT (Current Sci., 1938, **6**, 589—599).—A review. L. S. T.

Attainment of low temperatures. C. G. DARWIN (Mem. Proc. Manchester Phil. Soc., 1937—1938, **82**, 49—66).—A lecture. A. J. M.

Helium cryostat. J. C. DAUNT and K. MENDELSSOHN (Proc. Physical Soc., 1938, **50**, 525—533).—Two simple cryostats combining the advantages of a small liquefier with those of an ordinary He cryostat are described. N. M. B.

Modification of the Markley m.p. apparatus. M. S. SCHECHTER and H. L. HALLER (Ind. Eng. Chem. [Anal.], 1938, **10**, 392; cf. A., 1935, 56).—Side-arms are sealed on to the apparatus in such a way that the m.p. tubes can be inserted with their lower ends in contact with the bulb of the thermometer, which remains permanently in position. A commercial grade of chlorinated Ph_2, as recommended

by Markley, is a satisfactory substitute for the usual $H_2SO_4 + K_2SO_4$ mixture. L. S. T.

[Apparatus for determining] temperature of catalytic conversion.—See B., 1938, 853.

Measurement of true temperature of a luminous flame by Kurlbaum's method. Y. GODRON (Rev. Opt. théor. instr., 1936, **15**, 56—62; Chem. Zentr., 1936, ii, 508).—The method is based on the observation of a " black body " through the flame by means of a disappearing-filament pyrometer. The temp. of the flame is given by that temp. of the black body for which interposition of the flame does not change the pyrometer reading. H. J. E.

Phosphor-bronze resistance thermometers for the temperature region of liquid helium, suitable for use in strong magnetic fields. P. H. VAN LAER and W. H. KEESOM (Physica, 1938, **5**, 541—544).—Phosphor-bronze containing 0·05—0·1% of a Pb–Bi alloy (25% Bi) is suitable in fields of $\not>$8000 gauss. In stronger fields 0·2—0·3% of the alloy must be used. A. J. E. W.

Phosphor-bronze resistance thermometers for temperatures below 1° K., and carbon and ink thermometers for use in high magnetic fields between 1° and 4° K. H. VAN DIJK, W. H. KEESOM, and J. P. STELLER (Physica, 1938, **5**, 625—629).—The resistance of phosphor-bronze thermometers (cf. preceding abstract) at 0·25—1·5° K. is a linear function of the Curie temp. of $Gd_2(SO_4)_3$, and probably of T also. Resistance thermometers made of norite or India-ink show large dependence of R on I; the variation of R with T at low temp. is not uniform. Glass-ink gives better results, R being only slightly affected by a magnetic field; R–T, R–H, and R–I curves for typical thermometers are given. A. J. E. W.

Development and problems of liquid thermometry. W. GRUNDMANN (Glas u. Appar., 1936, **17**, 49—51, 59—61, 69—71, 75—78; Chem. Zentr., 1936, ii, 135).—The use of org. liquids for thermometry is exhaustively reviewed. J. S. A.

Ultra-violet microscopy. F. F. LUCAS (Chim. et Ind., 1938, **40**, 19—30).—The technique of the method and its applications are discussed with special reference to living organisms and to *Hevea* latex. C. R. H.

Simple method for the determination of the birefringence of fibres. R. H. MARRIOTT (J. Soc. Leather Trades' Chem., 1938, **22**, 294—296).—The birefringence of fibres is measured by placing a " quarter-wave mica plate " in between the polariser of crossed nicols and the fibre, and rotating the polariser until the fibre becomes dark. The angular rotation necessary to reach this point is a measure of the double refraction of the fibre. For rough determinations a piece of " 300 " Cellophane can be used instead of mica. Each degree of rotation is equiv. to a retardation of 3·27 mμ. if Na light is used as a source of illumination. D. P.

Production of continuous spectra by electrical excitation of rare gases. White light. M. LAPORTE (J. Phys. Radium, 1938, [vii], **9**, 228—236).—The operation and applications of an experimental arrangement for the production of continuous spectra of rare gases are described. W. R. A.

Effect of voltage and type of eyepiece on Lovibond colour readings. W. T. WATKINS (Oil and Soap, 1938, **15**, 190).—Using a 100-watt daylight bulb rated at 115 v., variations in line voltage from 100 to 120 v. caused only a very slight increase in the (red) readings (on white paraffin oil or empty colour tube). With the prismatic type of eyepiece the matching of the colours is easier than with the pin-hole eyepiece; further, the mean deviation from the average was slightly lower with the former type, which yields slightly lower (red) figures. E. L.

Wire grating spectrometer for the study of the far infra-red. P. BARCHEWITZ and M. PARODI (Compt. rend., 1938, **206**, 1891—1893).—The apparatus described is suitable for determining the transmission of solids in the λ range 20—100 μ. to an accuracy of ±5%; λλ may be measured to within ~1 μ. A. J. E. W.

Quantitative analysis of substances in solution by their absorption spectra in the ultra-violet region. P. GESTEAU (Compt. rend., 1938, **206**, 1806—1807).—The device described enables the max. thicknesses of solution for measurable transmission of a given radiation to be compared photographically. Two or more substances in a solution may be determined by comparison, at suitable λλ, with standard solutions. A. J. E. W.

Self-igniting flaming arc [in spectrographic analysis]. K. PFEILSTICKER (Z. Metallk., 1938, **30**, 211—214).—This type of arc has the following advantages: absence of mechanical vibrations, absence of air lines in the spectrum, a high light intensity, and possibility of using high a.c. currents, thereby reducing time of exposure of the film and increasing the sensitivity for certain elements. A. R. P.

Apparatus for evaporating solutions on electrodes [for spectrographic analysis]. H. A. WILHELM (Ind. Eng. Chem. [Anal.], 1938, **10**, 327). L. S. T.

Production of single-crystal cleavage surfaces of metals in a high vacuum. W. KLUGE (Physikal. Z., 1938, **39**, 582—585).—A method for cleaving a cylindrical single crystal of a metal (*e.g.*, Zn) in a high vac. is described; it is suitable for the prep. of surfaces for the examination of surface properties. The use of the method in the investigation of the surface photo-effect, the optical consts. of the metal surface, adsorption phenomena, secondary electron emission, and electron scattering is discussed. A. J. M.

Apparatus for measuring expansion with short range of measurement, reading by means of barrier-layer photo-cell. E. LEHR and H. GRANACHER (Forsch. Ingenieurw. Ausg., 1936, **A**, **7**, 66; Chem. Zentr., 1936, ii, 136). J. S. A.

New type of photo-emissive cell. G. A. BOUTRY and J. GILLOD (Compt. rend., 1938, **206**, 1807—1809; cf. A., 1937, I, 201).—Cells have been constructed using photo-cathodes consisting of a thin layer of Cs deposited on Ag. They have low dark-

current and saturation voltage, and give excellent proportionality between photo-electric current and incident light-flux for flux ratios ~1 : 30. A. J. E. W.

New phenomenon in the operation of the photo-electric cell at high frequencies. P. GRIVET (Compt. rend., 1938, **206**, 1798—1801).—Anomalous photo-electric current–accelerator voltage curves for a Cs cell illuminated with light modulated at 13·5 megacycles are discussed. A. J. E. W.

Very simple photo-electric photometer. R. HERZ (Z. wiss. Phot., 1938, **37**, 107—111).—A simple small table carries the film horizontally with the light below and a Se cell just above. The light is recorded by a galvanometer, a series of filters being interposable to bring densities to within the galvanometer range. The deflexion scale is calibrated, and results can be read from a prepared table of data. J. L.

Counting drops with the photo-electric relay. G. W. JOSTEN (Ind. Eng. Chem. [Anal.], 1938, **10**, 353).—The light beam is arranged to pass horizontally across the source of the drops, which interrupt it and produce the electrical impulses necessary for the counting. Up to 478 drops per min. can thus be counted. L. S. T.

Determination of *X*-ray intensities with the counter tube. P. OHLIN (Physikal. Z., 1938, **39**, 567—571).—A high-vac. *X*-ray spectrograph with a calcite crystal bent to a radius of 1 m. and attached to a counter tube is described. A new circuit is used for counting the impulses. The intensity distribution of the Ca $K\alpha$ doublet was determined. A. J. M.

***X*-Ray method for the chemical analysis of polished surfaces.** L. VON HÁMOS (Metallwirts., 1936, **15**, 433—436; Chem. Zentr., 1936, ii, 656; cf. A., 1934, 980).

***X*-Ray dosimeter.** K. MACKENZIE (Nature, 1938, **142**, 116—117).—The d.c. generated by a photo-electric cell exposed to short-wave radiation is used for the accurate measurement of the radiation val. in the arrangement described. L. S. T.

Concrete as a protective material against *X*-rays. F. HEIDENREICH and R. JAEGER (Physikal. Z., 1938, **39**, 541—546).—The protective action of concrete is compared with that of Pb for rays of 150—500 kv. and of varying degrees of homogeneity. It is possible to use concrete instead of Pb as a protective material against extra-hard *X*-rays. A. J. M.

Balanced circuit for electrometric titration. E. B. WORKING (Ind. Eng. Chem. [Anal.], 1938, **10**, 397—398).—The circuit and its component parts are described. The arrangement is suitable for measurements of potential from H or quinhydrone electrodes, thermocouples, etc. L. S. T.

Cathode ray-tube polarograph. Theory of method. R. H. MÜLLER, R. L. GARMAN, M. E. DROZ, and J. PETRAS (Ind. Eng. Chem. [Anal.], 1938, **10**, 339—341).—Apparatus and method are described. Current–voltage curves taken with an oscillograph using a small a.c. potential yield patterns which can be interpreted by the conventional Heyrovský method. The polarograms are viewed continuously and require no recording, and the actual identification is in terms of the same potentials used by the classical methods. The analysis can be repeated indefinitely. L. S. T.

Apparatus for determination of volume resistivity of insulating glasses. E. SEDDON (J. Sci. Instr., 1938, **15**, 226—231).—A null method of measuring high resistances (~10^{15} Ω) using the Lindemann electrometer is described. The method is adapted to measure the vol. resistivity of insulating glasses under controlled vac. and temp. conditions. Full details of the vac. chamber and thermostat arrangements are given. Figures for the variation of the vol. resistivity of 4 specimens of plate glass are given. J. A. D.

Micro-method for measuring specific conductance [of liquids]. P. A. WALKER (Science, 1938, **88**, 63—64).—Apparatus and technique are described. 0·1 c.c. of liquid is required. L. S. T.

Source of error in micro-cataphoretic measurements with a cylindrical-bore cell. D. C. HENRY (J.C.S., 1938, 997—999).—Errors which may arise in making allowance for electro-osmotic flow when using a Mattson type of cell are discussed. An error of 5% in locating the zone of zero electro-osmotic flow may lead to an error of 20% in the cataphoretic velocity. C. R. H.

Cuprous oxide and the cuprous oxide rectifier. H. NÖLDGE (Physikal. Z., 1938, **39**, 546—559).—The prep. and growth of Cu_2O crystals for Cu_2O rectifiers are reviewed, the effect of period of oxidation, temp., and air pressure on the growth being determined. The conductivity and rectifying power of various specimens were examined, and the best conditions for the prep. of rectifier plates were determined. For this purpose Cu is oxidised for 30 min. at 900° at 10—15 mm. pressure of air, tempered for 2 hr. at 450°, and used with Aquadag as a contact substance between the Cu_2O and the opposite electrode. If the Cu_2O is submitted to 300—500 kg. per sq. cm. pressure the rectifying action is further improved. The hysteresis effect is investigated and explained as due to ionic migration, the rectifying effect being due to electron discharge in the vac. space between Cu and Cu_2O. A. J. M.

Ozoniser for laboratory use. M. J. Goss and M. PHILLIPS (J. Assoc. Off. Agric. Chem., 1938, **21**, 327—331).—The apparatus is a modification of Briner, Patry, and de Luserna's (A., 1924, i, 290) and Smith's (A., 1925, ii, 896) apparatus. E. C. S.

Measurement of supervoltage *X*-rays with the free-air ionisation chamber. L. S. TAYLOR, G. SINGER, and A. L. CHARLTON (J. Res. Nat. Bur. Stand., 1938, **21**, 19—44).—The ionisation chamber, built on the guarded-field principle, permits measurements for *X*-ray excitation voltages of 150—350 kv. at atm. pressure, and from 200 kv. upwards at elevated pressures. From the chamber characteristics recorded between 200 and 400 kv., it has been shown that increased plate separation is necessary at high voltages. The construction and working of the apparatus are fully described and illustrated. C. R. H.

Thyratron counter of high counting speed. F. L. UFFELMANN (J. Sci. Instr., 1938, **15**, 222—226).—The Lewis modification of the Wynn-Williams "scale-of-two" counter (cf. A., 1938, I, 101) has been further modified to work at an input frequency of 20 kc. per sec. The circuit consists of seven "scale-of-two" linkages followed by a "Cenco" counter and measures time intervals with a max. error of $8{\cdot}3\times10^{-5}$ sec. J. A. D.

Intermittent amplifier for the rapid counting of Geiger-Müller impulses. L. KOWARSKI and S. WINTER (J. Phys. Radium, 1938, [vii], **9**, 251—258).—The construction, operation, and performance of an intermittent amplifier are described. W. R. A.

Vacuum tube counting circuits. H. J. REICH (Rev. Sci. Instr., 1938, **9**, 222—223).—Circuits based on the Eccles-Jordan trigger circuit and the van der Pol relaxation oscillator circuit are described. They are effective at frequencies >15,000 cycles per sec. A. J. M.

Circuits for control of Geiger-Müller counters and for scaling and recording their impulses. T. H. JOHNSON (Rev. Sci. Instr., 1938, **9**, 218—222).—The theory of the controlling action of a vac. tube in circuits similar to those of Neher *et al.* (A., 1936, 1084; 1938, 1, 277) is considered, and an improvement in the circuit of Neher and Pickering (A., 1938, I, 277) is proposed. The four-valve circuit described controls the counter, scales down the impulse rate by any desired factor, and records the counts. A Ne tube coupled multivibrator delay circuit for recording single or coincidence counter pulses is described. A. J. M.

Portable recording tube counter circuit. A. W. COVEN (Rev. Sci. Instr., 1938, **9**, 230).—A portable circuit based on that of Neher *et al.* (A., 1936, 1084) combined with a recording circuit is described. The counter is designed to be inserted into cavities in rocks etc., and is thus useful for the measurement of weak sources of γ-radiation. A. J. M.

Electron diffraction methods of studying organic films. L. H. GERMER (J. Appl. Physics, 1938, **9**, 143—147).—A review. H. J. E.

[Electron] ultramicroscope. ANON. (Chem.-Ztg., 1938, **62**, 561—566).—A review dealing with the development of the electron ultramicroscope, and its applications in biology, medicine, and technology. A. J. M.

Electron microscope for high magnifications. A. K. NUTTALL (Metro-Vickers Gaz., 1938, **17**, 256—259).—The principle and construction of a continuously evacuated instrument are described. R. B. C.

Simple magnetic apparatus for phase transformation studies of ferrous alloys. R. BUEHL and J. WULFF (Rev. Sci. Instr., 1938, **9**, 224—228).—Apparatus for the investigation of sluggish phase transformations in ferromagnetic alloys at high temp. is described. The force exerted on a small specimen suspended in a furnace between the poles of an electromagnet producing a magnetic field of uniform gradient is determined. The curve of magnetic induction against temp. is obtained. Some results are given for stainless steel. The apparatus is of use for the study of allotropic changes in alloys which have one ferromagnetic phase with a Curie point > transition temp., and for the determination of small quantities of a ferromagnetic phase (*e.g.*, Fe_3C in stainless steel). Variation in internal strain at temp. < transition temp. can also be studied. A. J. M.

Syringe attachment for accurate volumetric work. A. L. CHANEY (Ind. Eng. Chem. [Anal.], 1938, **10**, 326—327).—Suitable stops in the form of adjustable metal rods attached to the head of a hypodermic syringe make possible the elimination of air bubbles produced during filling. The syringe is especially suitable for blood analyses. In 10-c.c. syringes calibration to 0·001 c.c. of H_2O can be effected. L. S. T.

Gasometric analysis. J. MALÝ (Chem. Obzor, 1935, **10**, 223—226; Chem. Zentr., 1936, ii, 657).—An improved volumenometer and its applications are described. H. J. E.

Improved trap for moisture determination by distillation. E. E. LANGELAND and R. W. PRATT (Ind. Eng. Chem. [Anal.], 1938, **10**, 400—402).—A trap suitable for determining H_2O in materials by distillation with immiscible liquids heavier than H_2O, *e.g.*, C_2Cl_4, is described. The addition to the distillate of Tergitol 4, but not Tergitol 7, as a depressor of γ, increases the accuracy of reading the vol. of H_2O. L. S. T.

Simplified apparatus for studying the variation in weight of a body as a function of a linearly increasing temperature. L. BLANCHARD (Bull. Soc. chim., 1938, [v], **5**, 965—970).—A furnace which is connected with an electrolytic rheostat is described. The latter consists of a lower fixed electrode and an upper electrode floating on the surface of the electrolyte, which is a solution of $CuSO_4$. Capillaries siphon the electrolyte from the rheostat at a prearranged rate and, by so decreasing the distance between the electrodes, linearly increase the current passing through the furnace. C. R. H.

Capillary clamp. H. K. ALBER (Ind. Eng. Chem. [Anal.], 1938, **10**, 348). L. S. T.

Electrolytic silver wool in the filling of microcombustion tubes. W. MACNEVIN (Ind. Eng. Chem. [Anal.], 1938, **10**, 341).—Ag deposited electrolytically in the form of closely interwoven clusters of crystals is preferred to Ag wire for use in the determination of C and H by Pregl's method. L. S. T.

Automatic continuous percolator. M. S. SCHECHTER and H. L. HALLER (Ind. Eng. Chem. [Anal.], 1938, **10**, 328).—An apparatus for the extraction of plant materials with Et_2O or light petroleum is described. When adjusted it will operate for 48 hr. without attention and without serious loss of solvent. L. S. T.

Ultrafiltration. M. AMAT and J. DUCLAUX (J. Chim. phys., 1938, **35**, 147—151).—The prep. of membranes for ultrafiltration by dissolving cellulose acetate in aq. $Mg(ClO_4)_2$, pouring as a film on a glass plate, and coagulating by immersion in H_2O is described. The porosity of the membranes is independent of their thickness and can be varied in the

ratio 1 : 75,000 according to the concn. of the cellulose acetate solution. E. S. H.

Extraction of gases, especially from blood.—See A., 1938, III, 561.

Easily-constructed orifice. C. P. BAKER and W. A. MCGRATH (Ind. Eng. Chem. [Anal.], 1938, **10**, 402).—An orifice for insertion in a pipe line in order to determine the velocity of a fluid is described. L. S. T.

Simplified precision oil manometer. T. C. CHADWICK and S. PALKIN (Ind. Eng. Chem. [Anal.], 1938, **10**, 399—400).—The manometer described is, in effect, a single U-tube requiring no second backing liquid such as Hg to produce movement of the oil column from the closed end, which is a grease-sealed stopcock. Comparative data with other gauges are tabulated. L. S. T.

Stopcock suitable for alkali solutions etc. G. ROEDER (Chem.-Ztg., 1938, **62**, 262).—The seating of the cock is glass roughened by emery whereas the surface of the glass cock is highly polished; a closely fitting rubber gasket between the two prevents sticking and is held in position by a glass disc fitting into the end of the seating in such a way as to prevent movement of the gasket. A. R. P.

Laboratory stirring apparatus. F. H. W. LOEWE (Süddeut. Apoth.-Ztg., 1938, **78**, 356).—A glass propeller with a straight-drive is operated by means of a special electrically-driven motor. L. S. T.

Flow indicator for water-cooling systems. W. M. CADY (Rev. Sci. Instr., 1938, **9**, 229).—Apparatus for indicating the flow of H_2O in H_2O-cooling systems where it has to be pumped away against a back pressure, and for the observation of flow in parallel branches of a cooling system, is described. A. J. M.

Measurement of the surface tension of liquids. V. NAGGIAR (Compt. rend., 1938, **206**, 1882—1884).—A drop of the liquid is placed in a circular hole in a plane-parallel plate; the radii of curvature of the resulting concave surfaces, and the thickness of the drop along its axis, are measured with two microscopes coaxial with the drop. ρ being known, γ may then be calc. Accuracy to $\pm 1\%$ is claimed. A. J. E. W.

Viscosity measurement. M. R. CANNON and M. R. FENSKE (Ind. Eng. Chem. [Anal.], 1938, **10**, 297—301).—The operating characteristics of simple, modified Ostwald viscosimeters suitable for wide ranges of η measurements are discussed. Sources of error in capillary viscosimeters are analysed, and equations for computing the necessary corrections are given. Comparisons with other types of capillary viscosimeters show that the modified Ostwald viscosimeters described are as accurate as any now available and give results that are reproducible to $\pm 0{\cdot}2\%$. L. S. T.

Influence of surface tension on the measurement of viscosity. Viscosity of methyl alcohol. G. JONES and H. J. FORNWALT (J. Amer. Chem. Soc., 1938, **60**, 1683—1693).—A mathematical analysis of the influence of γ on η is given. From the results a method of estimating the magnitude of the correction which should be applied to the results obtained with the Ostwald viscosimeter is developed. A viscosimeter in which the error due to γ is reduced to a min. has been designed. The relative η of MeOH at 25° is 0·6084. E. S. H.

Porous substances, impregnated with calcium chloride as desiccants. J. B. NIELSEN (Kem. Maanedsbl. nord. Handelsbl. kem. Ind., 1936, **17**, 49—53; Chem. Zentr., 1936, ii, 1764).—$CaCl_2$ + gas-mask C gives the best results, and is recommended for drying a current of air etc. Regeneration by heating can be accomplished readily. L. S. T.

Accidents with potassium nitrate baths. HAID and FRENZEL (Oberflächentech., 1936, **13**, 102—103; Chem. Zentr., 1936, ii, 517).—The occurrence and prevention of corrosion of Fe by local overheating of fused KNO_3 and $NaNO_3$, and the vigorous reaction of KNO_3 with even massive Al at temp. >800°, especially in presence of Fe_3O_4, are discussed. The baths should not be operated above 600°. H. J. E.

Analytical ultra-centrifuge and the examination of filterable viruses.—See A., 1938, III, 706.

Silvering of glass.—See B., 1938, 908.

Le Chatelier and the synthesis of ammonia. (A) H. S. VAN KLOOSTER. (B) A. SILVERMAN (J. Chem. Educ., 1938, **15**, 289).—(A) A correction (cf. A., 1938, I, 217). (B) Acknowledgment. L. S. T.

Geochemistry.

Concentration and measurement of atmospheric ozone. F. A. PANETH and J. L. EDGAR (Nature, 1938, **142**, 112—113).—The O_3 from ~500 l. is condensed on SiO_2 gel at liquid air temp. When redistilled below −120°, the NO_2 is held back and can be finally determined by the *m*-4-xylenol method (B., 1935, 1020), and the O_3 is determined in the usual way by means of KI and starch. The redistilled O_3 can also be collected in a glass tube with quartz windows and its absorption of ultra-violet light measured. Data for the O_3 and NO_2 contents of air at South Kensington and Kew are recorded. The mean val. for the former locality is $1{\cdot}1 \times 10^{-6}$ vol.-% of O_3. L. S. T.

Occurrence of carbon dioxide. F. E. E. GERMANN (Science, 1938, **87**, 513—521).—A lecture. L. S. T.

Determination of iodine in natural waters of Moscow. S. V. BRUEVITSCH and O. P. OPARINA (Hydro-Chem. Mat., 1938, **10**, 239—242). J. J. B.

Salt content of certain lakes. N. GUSEV (Hydro-Chem. Mat., 1938, **10**, 101—183).—Data for 50 lakes and reservoirs in North Caucasus are given. J. J. B.

Organic matter in sea-water and foam in the south-eastern part of the Caspian Sea (October–November, 1936). N. A. SKOPINTZEV (Compt.

rend. Acad. Sci. U.R.S.S., 1938, **18**, 453—458).—Comprehensive data for the oxidisability and biological consumption of O_2 for sea-H_2O and foam are recorded and discussed. H. J. E.

Te Aroha thermal water. J. Henderson (New Zealand J. Sci. Tech., 1938, **19**, 721—731).—New bore-holes through much-altered andesite impregnated with pyrite yield intermittent geyser-like eruptions of hot (186° F.) mineral H_2O. Solids (815·1 parts per 100,000) consist mainly of $NaHCO_3$ with some B etc., and traces of Li, As, Br, and I. L. J. S.

Analysis of mineral water from the Johannis spring at Krynica. A. Rausch and S. Jurkowski (Arch. Chemji Farm., 1936, **3**, 20—26; Chem. Zentr., 1936, ii, 1773).—1 kg. of H_2O contains $K^{\cdot}$ 0·001639, $Na^{\cdot}$ 0·008915, $Li^{\cdot}$ 0·000036, $NH_4^{\cdot}$ trace, $Ca^{\cdot\cdot}$ 0·149609, $Ba^{\cdot\cdot}$ trace, $Mg^{\cdot\cdot}$ 0·019626, $Fe^{\cdot\cdot}$ 0·006536, $Ma^{\cdot\cdot}$ [? $Mn^{\cdot\cdot}$] 0·000706, $Al^{\cdot\cdot\cdot}$ 0·000196, Cl' 0·010832, I' 0·000001, SO_4'' 0·040525, HPO_4'' 0·000169, HCO_3' 0·5274, H_2SiO_3 0·025057 g. L. S. T.

Analysis of mineral water from the Joseph spring at Krynica. S. Jurkowski and A. Rausch (Arch. Chemji Farm., 1936, **3**, 50—59; Chem. Zentr., 1936, ii, 1773).—1 kg. of H_2O contains $K^{\cdot}$ 0·001877, $Na^{\cdot}$ 0·007939, $Li^{\cdot}$ 0·000033, $Ca^{\cdot\cdot}$ 0·28269, $Ba^{\cdot\cdot}$ 0·000138, $Mg^{\cdot\cdot}$ 0·026813, $Fe^{\cdot\cdot}$ 0·007982, $Mn^{\cdot\cdot}$ 0·000898, $Al^{\cdot\cdot\cdot}$ 0·000046, Cl' 0·00706, Br' trace, I' 0·000002, SO_4'' 0·095945, HPO_4'' trace, HCO_3' 0·90548, H_2SiO_3 0·039158 g. L. S. T.

Water of the Boza lagoon. V. Carcamo (Bol. Soc. Quim. Peru, 1936, **1**, 44—48; Chem. Zentr., 1936, ii, 1773).—The H_2O reacts strongly alkaline; it contains approx. 20 g. of $Na^{\cdot}$ and 16·5 g. of Cl' per l., besides abundant $K^{\cdot}$, $Li^{\cdot}$, I', Br', and BO_3'''. L. S. T.

Radioactive phenomena and presence of inert gases in thermal waters of Ssoko Banja. D. K. Jovanovitsch (B. Serb. Königl. Akad., 1934, **162**, 1—16; Chem. Zentr., 1936, ii, 449).—Measurements of radioactivity and analyses of the rare gases contained in the springs are recorded. H. J. E.

Humic acids in water. P. Thieme (Deuts. Licht- u. Wasserfach-Ztg., 1936, 177—181; Chem. Zentr., 1936, ii, 519).—Humic soil samples give coloured extracts only with alkali hydroxide or carbonate. Aëration does not remove humic material from the fresh upper layers. H. J. E.

Hydro-geology of East Flanders. R. Baetslé and A. Hacquaert (Natuurwetensch. Tijds., 1938, **20**, 165—171).—Various ground waters from different regions of E. Flanders have been examined for p_H, total and permanent hardness, total solids, ash, SO_4'', Cl', alkalinity (combined CO_2), reducing power (acid $KMnO_4$), NO_3', NO_2', and $NH_4^{\cdot}$ contents and the results correlated with the geological characteristics of the region. S. C.

Intense radioactivity of the superficial ocean floor. (Sir) J. Larmor (Nature, 1938, **142**, 37).—A discussion. L. S. T.

Microchemical investigations on siliceous dusts. J. W. Matthews (Analyst, 1938, **63**, 467—478).—A summary of work recorded previously (B., 1935, 81, 209; 1937, 852, 853, 1286) on the chemical properties of dusts which cause or do not cause silicosis. Methods of collecting samples and micro-analysing them are described. It is suggested that dusts are dangerous if they dissolve to give sol. SiO_2 and that the danger might be reduced by mixture with cement etc. T. H. G.

Osseo [Canada] meteorite. J. P. Marble (Amer. Min., 1938, **23**, 282—285).—The meteorite, a coarse kamacitic octahedrite, bearing a few troilite nodules and rare schreibersite, has Fe 92·89, Ni 6·51, Co 0·11, Cu 0·10, P 0·50, S 0·00, Pt etc. 0·02, C 0·007, total 100·137%. L. S. T.

Effect of pressure on the rigidity of rocks. II. F. Birch and D. Bancroft (J. Geol., 1938, **46**, 113—141).—A discussion of results obtained previously (A., 1938, 1, 280). L. S. T.

New variation diagrams for groups of igneous rocks. E. S. Larsen (J. Geol., 1938, **46**, 505—520).—A new method of constructing variation diagrams for plotting groups of chemical analyses of related igneous rocks is described and illustrated. L. S. T.

Chemical investigation of gavite from Gavatal [Voltri group]. R. Rondolino (Period. Min., 1936, **7**, 207—210; Chem. Zentr., 1936, ii, 1510).—The fibrous gavite has the approx. formula $6SiO_2,5(Fe^{II},Ni^{II},Mg)O,3H_2O$, d 2·432, n parallel to the fibre axis ~1·591. L. S. T.

Minerals of Piampaludo in the Voltri group. R. Rondolino (Period. Min., 1936, **7**, 193—206; Chem. Zentr., 1936, ii, 1510).—Petrographic investigation of these rocks showed the presence of garnet, chlorite, epidote, titanite, and magnetite. L. S. T.

Minerals of the Szepes-Gomor mountains. L. Tokody (Math. nat. Anz. ung. Akad. Wiss., 1936, **54**, 650—671; Chem. Zentr., 1936, ii, 1322—1323).—Crystallographic data for tourmaline, sphalerite, arsenopyrite, chalcopyrite, hyalite, gypsum, barytes, rhodocrosite, and sericite from different localities are recorded. L. S. T.

Identity of austinite and brickerite. W. Brendler (Amer. Min., 1938, **23**, 347—349).—Optical properties and chemical composition show the identity of "austinite" (A., 1935, 726) and "brickerite" (Ahlfeld and Mosebach, Zentr. Min., 1936, **A**, 226—231). Priority should be given to the name "austinite." The mineral from Lomitos, Bolivia, contains CaO 21·12, ZnO 30·51, As_2O_5 42·48, Sb_2O_5 0·53, P_2O_5, V_2O_5, CO_2 none, H_2O+ 3·35, H_2O- 0·12, Fe_2O_3 0·69, MnO 0·12, insol. 1·11, total 99·91%. L. S. T.

Lead and zinc ore deposits of the Heiterwand, Tyrol. F. Ruprecht (Montan. Runds., 1938, **30**, No. 1, 11—16; No. 2, 1—8; No. 3, 1—6).—Analyses are given. R. B. C.

Genesis of certain Adirondack garnet deposits. W. J. Miller (Amer. Min., 1938, **23**, 399—408; cf. Econ. Geol., 1912, **7**, 493).—The origin of garnets with and without hornblende envelopes occurring in N.W. Warren County, N.Y., is discussed. L. S. T.

Contact zone of Sheep Creek, Little Belt Mountains, Montana. J. H. TAYLOR (Geol. Mag., 1938, **75**, 219—226).—Metamorphic effects are discussed, and six chemical analyses [W. H. HERDSMAN] of lamprophyres, limestones, and a shale are recorded. L. S. T.

Evolution of the granodioritic rocks of the south-eastern end of the Kopaonik batholith, Yugoslavia. G. WILSON (Geol. Mag., 1938, **75**, 193—218).—Chemical analyses [H. L. RILEY, A. W. GROVES] of four hornfelses and ten rocks of the granodioritic suite, Kopaonik mountains, are included. L. S. T.

Kodiak and adjacent islands, Alaska. S. R. CAPPS (U.S. Geol. Survey, 1937, Bull., 880-c, Min. Resources of Alaska, 1935, 111—184).—The geology of the district is described. Au placers and lodes are also discussed. L. S. T.

Geology and ore deposits of the Bayhorse region, Custer County, Idaho. C. P. ROSS (U.S. Geol. Survey, 1937, Bull., 877, 161 pp.).—Two chemical analyses of travertine and three analyses of hot-spring H_2O are included. Lodes and mines of the Bayhorse, Boulder Creek, and East Fork districts are described. L. S. T.

Geology and mineral deposits of the Snowmass Mountain area, Gunnison County, Colorado. J. W. VANDERWILT (U.S. Geol. Survey, 1937, Bull., 884, 184 pp.).—A chemical analysis [J. G. FAIRCHILD] of pink granite from Bear Basin is given, and twelve analyses of Tertiary igneous rocks in Colorado are compared with it. Analyses [*idem*] of quartz diorite, albite granite, granodiorite, and rocks adjacent to felspathic sandstone are also recorded. The ore deposits and minerals of Treasure mountain are described, together with numerous mines and prospects of the whole area. The history, development, composition, properties, uses, etc. of the Yule Colorado marble are discussed. L. S. T.

Petrographic and chemical data on the Canadian Shield. F. F. GROUT (J. Geol., 1938, **46**, 486—504).—Petrographic notes and 39 new chemical analyses are given for the following: Lyndhurst, Ontario, batholith and related rocks, Killarney granites and related rocks, granodiorites between Lake Superior and Winnipeg, granites of the Labrador Coast, and granites and granodiorites etc. north of Lake Winnipeg. Preliminary estimates of the composition of the earth's crust in the Shield and in certain parts of it are also given. L. S. T.

Esboitic crystallisation of orbicular rocks. P. ESKOLA (J. Geol., 1938, **46**, 448—485).—Esboitic crystallisation of orbicular rocks is the process by which the orbicules have attained a composition in which the dominant plagioclase is oligoclase or andesine. Photographs, descriptions, and chemical analyses of orbicular rocks from Corsica, from Pöytyä, Laukaa, Kangasniemi, and Lintusaari, Finland, and from Kortfors, Sweden, are reproduced. The nature of the rock nuclei, the composition of the felspars, which are the minerals determining the structure of the esboitic orbicules, and the genesis of the orbicules are discussed. L. S. T.

Relation of pyrrhotite to other sulphides. R. L. HEWITT (Econ. Geol., 1938, **33**, 305—338; cf. A., 1937, I, 270).—The results of heating small portions of ore sealed in Pyrex or fused SiO_2 at temp. up to 900° for periods up to 50 hr. and cooling, generally as rapidly as possible in air, are recorded for pyrrhotite (I) containing approx. 10% of pentlandite (II) (from Sudbury, Ontario), chalcopyrite (III) containing approx. 30% of (I) (from Parry Sound, Ontario), and mixtures of (I) and galena (IV). Microscopical examination of the products showed that (I) and (II) form a solid solution, with (I) predominating, between 425° and 450°. On slow cooling from 800° unmixing occurs with (II) segregating around the boundaries of (I). The presence of oriented laths of (I) in the unmixed (II) indicates that a second solid solution with (II) as the dominant mineral is formed, or that (II) breaks down and expels (I). (I) and (III) form two solid solutions. Above 300°, (I) dissolves in (III) and chalcopyrrhotite is formed; above 600°, (III) dissolves in (I), and, on unmixing, forms oriented laths in (I). Crystals of (I) and (III) were formed by sublimation at temp. as low as 400°. (I) and (IV) formed a eutectic (29 : 71) between 765° and 775°, and crystals of (IV) were produced at 700°, probably by sublimation. L. S. T.

Rapakivi granites [of Fennoscandia]. H. G. BACKLUND (J. Geol., 1938, **46**, 339—396).—Morphology, structure, associated rocks, weathering, texture, mineralogy, crystallisation, chemistry, differentiation, genetics, and radioactivity are discussed. Numerous partial analyses are reproduced. L. S. T.

Crystallisation equilibrium in nepheline–albite–silica mixtures with fayalite. N. L. BOWEN and J. F. SCHAIRER (J. Geol., 1938, **46**, 397—411).—Details of a thermal study of the system $NaAlSiO_4$–FeO–SiO_2 are given. The cryst. phases formed in the various compositions are cristobalite, tridymite (I), albite (II), fayalite (III), nepheline (IV), carnegieite, hercynite, and wüstite. Two ternary eutectics, one between (I), (II), and (III) at 980°± 10°, which can be regarded as a simplified fayalite rhyolite, and the other between (IV), (II), and (III), at 990°±10°, regarded as a simplified fayalite phonolite, occur. The results are discussed in relation to the origin of natural phenolites, trachytes, and rhyolites bearing (III). The equilibrium diagram of the above system reproduced revises that given previously (A., 1937, I, 101). L. S. T.

Late sodic differentiates of basic eruptives. H. VON ECKERMANN (J. Geol., 1938, **46**, 412—437).—Chemical analyses of rocks from Gubben island, North Ulfö island, West Värnsingen island, and Nordingrå are tabulated and discussed. L. S. T.

Eclogite in the Black Forest and its retrograde alteration. O. H. ERDMANNSDÖRFFER (J. Geol., 1938, **46**, 438—447).—A chemical analysis [M. ZUMBUSCH] of a hornblende-eclogite is reported. L. S. T.

Minerals from S. California. J. MURDOCH and R. W. WEBB (Amer. Min., 1938, **23**, 349—355).—Okenite, grossularite, and hyalite from Crestmore, Riverside County, almandite garnet from George's

Gap, San Gabriel Mountains, zeolites from Acton, Los Angeles County, gibbsite from San Joaquin Valley, Kern County, gastaldite from Rincon, San Diego County, mariposite and clinozoisite from San Francisquito Canyon, and lamellar quartz from Twenty-nine Palms, San Bernardino County, are described. L. S. T.

Anthophyllite and cummingtonite–grunerite series. A. N. WINCHELL (Amer. Min., 1938, **23**, 329—333).—Variation diagrams for both series are reproduced. The anthophyllite (I) and cummingtonite (II) series illustrate a case of isodimorphism, since the (II) series extends beyond 60% of $H_2Mg_7Si_8O_{24}$ and the (I) series to approx. 90% of $H_2Fe_7Si_8O_{24}$. L. S. T.

Vivianite from Ruth, Nevada. V. P. GIANELLA (Amer. Min., 1938, **23**, 414).—The first occurrence reported from Nevada. L. S. T.

Veatchite, a new calcium borate from Lang, California. G. SWITZER (Amer. Min., 1938, **23**, 409—411).—Veatchite, $Ca_2B_6O_{11},2H_2O$, monoclinic, a_0 6·72, b_0 41·26, c_0 41·20 A., β 67°, biaxial, positive, n_x 1·551, n_y 1·553, n_z 1·621, all $\pm$0·002, hardness 2, d 2·69, calc. mol. wt. of unit cell 17,126, has CaO 31·08, B_2O_3 59·03, H_2O 9·50, insol. 0·62, total 100·23% [F. A. GONYER], and occurs in white cross-fibre veins in limestone and howlite. L. S. T.

Epithermal hübnerite from the Monitor District, Alpine County, California. V. P. GIANELLA (Econ. Geol., 1938, **33**, 339—348).—The mode of occurrence of hübnerite in the ore specimens from the Zaca mine is described. L. S. T.

Amphibolisation of sills and dykes in the Libby Quadrangle, Montana. R. GIBSON and W. F. JENKS (Amer. Min., 1938, **23**, 302—313). L. S. T.

Monazite, xenotime, and zircon from apatite-bearing pegmatites of the Styrian-Carinthian old crystalline zone. H. MEIXNER (Z. Krist., 1938, **99**, 50—55).—New occurrences of the minerals are characterised, mainly by crystallographic data, and discussed with reference to locality. I. McA.

Quartz from Felsöbánya (now Baia Sprie, Rumania). L. TOKODY (Z. Krist., 1938, **99**, 56—60).—A description of surface morphology with special emphasis on twinning. Both *D*- and *L*-forms occur. I. McA.

Spectroscopic investigation of aragonite and baryta from Katanga. A. SCHOEP and J. EECKHOUT (Natuurwetensch. Tijds., 1938, **20**, 134—137).—Aragonite crystals embedded in pitchblende from Shinkolobwe contained Sr (0·1%), Pb (0·1—0·2%), traces of Ba, Na, Co, and Mn, but no Mg. Baryta from Shangulowe (Congo) contained only Ca, Sr, and traces of Na as foreign metals. S. C.

Copiapite from the Vedrin mine. A. SCHOEP (Natuurwetensch. Tijds., 1938, **20**, 141—142).—The first occurrence of copiapite, $2Fe_2O_3,5SO_3,17H_2O$, in quantity in Belgium is recorded. S. C.

Injection rocks of the Kotto region. E. POLINARD (Natuurwetensch. Tijds., 1938, **20**, 143—155).—The geology, mode of formation, and composition of the injected rocks (schists, gneiss, amphibolites, and exceptionally quartzites) of the Kotto basin to the north of Bria in the Oubangui-Chari region of French Equatorial Africa are discussed. S. C.

Blue rock salt. II. K. PRZIBRAM (Kali, 1936, **30**, 61—63; Chem. Zentr., 1936, ii, 753; cf. A., 1928, 391).—A discussion of the origin of the colour, its relation to the rate of growth of the crystal, the effect of pressure, and the analogy to the coloration of anhydrite and langbeinite. H. J. E.

Basal rocks and green crystalline slates of the Sstara Planina. J. S. TOMITSCH (B. Serb. Königl. Akad., 1934, **162**, 87—130; Chem. Zentr., 1936, ii, 449).—Petrological characteristics of the rocks and their metamorphosis products are described. H. J. E.

Geochemistry of Swedish sulphide ores. S. LANDERGREN (Geol. För. Stockholm Förhandl., 1935, **57**, 626—636; Chem. Zentr., 1936, ii, 40).—The Saxberg and Garpenberg breccia ores contain chiefly Ni, with Zn 11 and SiO_2 30%. J. S. A.

Micro-organic rock weathering. F. HARDY (Nature, 1938, **142**, 37—38).—Chemical analyses [G. C. L. BOURNE] of percolated H_2O which had passed through sterilised granular dolerite and granite show that the degree of weathering is greater when the H_2O is first inoculated with washings from the surface of weathering rock of the same kind. The increased weathering mainly concerns Ca, Mg, and CO_3'' (or HCO_3'); Fe'' is oxidised to Fe'''. L. S. T.

Luminescence investigations with fluorites and other minerals. II. H. HABERLANDT (Sitzungsber. Akad. Wiss. Wien, 1935, IIa, **144**, 663—666; Chem. Zentr., 1936, ii, 1304; cf. A., 1936, 1089).—The close connexion between fluorescence and thermoluminescence with the rare-earth content and the mineral origin has been confirmed by the investigation of numerous new occurrences of fluorite. In two fluorites a zonal arrangement of the red radio-fluorescence in the interior of the cubic crystals was established. The thermoluminescence spectra of calcite from Altenberg near Iglau, anhydrite (I), strontianite, and danburite showed lines due to rare earths. With (I), thermoluminescence varies considerably according to the occurrence and conditions of formation. U bands were detected in the fluorescence spectra of Mexican hyalite, bolivarite, sodalite, and haüyne, but not leucite or nephelite. L. S. T.

Shearing experiments on minerals. E. S. LARSEN and P. W. BRIDGMAN (Amer. J. Sci., 1938, [v], **36**, 81—94).—Shearing, under pressures > 50,000 kg. per sq. cm., of mixtures of orthoclase, halloysite, etc. (of the composition of sericite), chlorite, sericite, etc. (to give biotite), and various other minerals appeared, by optical and *X*-ray examination, to produce chemical changes, but no metamorphic "stress minerals" were formed. L. J. S.

Trap rock from Holyoke Range, Massachusetts. N. P. STEVENS (Amer. J. Sci., 1938, [v], **36**, 150—154).—Two closely agreeing chemical

analyses are given of diabase from a sill and a dike, with petrographical descriptions. L. J. S.

Ungemachite and clino-ungemachite: new minerals from Chile. M. A. PEACOCK and M. C. BANDY (Amer. Min., 1938, **23**, 314—328).—Details are now given (cf. A., 1938, 1, 282). L. S. T.

Granites, microgranites, and rhyolites in the eastern extremity of the Massif de Guéret, and particularly the existence of tourmaline in certain rhyolites. A. DEMAY (Compt. rend., 1938, **206**, 1905—1907).—Full chemical analyses are given for typical rocks of the region considered, and the occurrence of tourmaline and biotite in rhyolite adjoining granite deposits is described and discussed. A. J. E. W.

Minerals in cavities in basalt from Lake Balaton, Hungary. B. MAURITZ (Tsch. Min. Petr. Mitt., 1938, **50**, 93—106).—Descriptions are given of the various minerals (zeolites, thaumasite, felspars, augite, aragonite, opal, etc.) found in amygdaloidal cavities in the basalt from the quarries at Haláp and Gulács. L. J. S.

Differentiation in diabases in eastern Thuringia. P. WAGNER (Tsch. Min. Petr. Mitt., 1938, **50**, 107—180).—Outcrops of large intrusions are mapped and petrographical descriptions are given of the rocks, which range in depth from quartz-diabase (SiO_2 56·11, MgO 4·81%) to a picritic rock (SiO_2 43·20, MgO 17·64%). L. J. S.

Zeolites in New Mexico. C. E. NEEDHAM (Amer. Min., 1938, **23**, 285—287).—Thomsonite (I), analcite, and natrolite occur in a dark-coloured andesite from the Valle del Ojo do la Parida. A zeolite, apparently (I), also occurs in the bentonitic tuff of the Blue Canyon, Socorro Mts. L. S. T.

Formation of iddingsite. A. B. EDWARDS (Amer. Min., 1938, **23**, 277—281).—Iddingsite (I), $MgO,Fe_2O_3,3SiO_2,4H_2O$, is formed from olivine during, or after, extrusion, according to the temp. of the magma at the time of extrusion. If the magma cooled sufficiently before extrusion insufficient Fe oxides remain in the residual volatile matter for (I) to be formed. L. S. T.

Uraninite and associated minerals from Haddam Neck, Connecticut. E. INGERSON (Amer. Min., 1938, **23**, 269—276).—Uraninite (I) from Rock Landing Quarry is described. The estimated age is $28—29 \times 10^7$ years. Noteworthy minerals associated with (I) are gummite, autunite, torbernite, and columbite. L. S. T.

Catlinite and the Sioux quartzite. E. L. BERG (Amer. Min., 1938, **23**, 258—268).—The mineralogy and petrography of the catlinite bed at Pipestone, Minnesota, are described. Catlinite (I), ρ 2·746, hardness approx. 2·5, or red pipestone consists mainly of sericite with pyrophyllite (II) as the light-coloured replacement mineral. (I) practically free from (II) has SiO_2 49·01, Al_2O_3 35·17, Fe_2O_3 3·06, FeO none, MgO 0·23, CaO 0·05, Na_2O 0·6, K_2O 5·62, H_2O+ 5·63, H_2O- 0·24, TiO_2 0·44, Li_2O 0·16, ignition loss (less total H_2O) 0·24, total 99·91% [R. B. ELLESTAD]. The origin of the quartzite deposits is discussed. L. S. T.

Petrologic results of a study of the minerals from the Tertiary volcanic rocks of the San Juan Region, Colorado. Plagioclase felspars. E. S. LARSEN, J. IRVING, F. A. GONYER, and E. S. LARSEN 3rd (Amer. Min., 1938, **23**, 227—257; cf. A., 1938, I, 49).—Plagioclase (I) is the chief mineral among the phenocrysts of the San Juan lavas. The variations in the composition of (I) in an individual rock are described, and are explained in terms of progressive crystallisation etc. Chemical analyses of nine plagioclases are recorded. A statistical study of the plagioclase phenocrysts from 70 analysed rocks has been made, and curves showing the relationship between composition of the rock and its plagioclase (anorthite) are reproduced. The origin of the phenocrysts is discussed; most of them did not crystallise from a magma of the composition of the lava in which they are found. L. S. T.

Lower silurian geosynclinal phosphorites in the N.E. branch of the Karatau range. P. L. BEZRUKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 445—448).—The deposits are described. H. J. E

Tetrahedral structure of minerals. A. E. FERSMAN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 449—452).—Data relating to ions of the type MO_4 are summarised and discussed. The max. stability is observed in ions of radius 0·3 to 0·4 A. Ions of smaller dimensions make up flat triangles with a 3-co-ordination. Ions with radius 0·4—0·7 A. form tetrahedra with 4-co-ordination only at elevated temp. Approx. 85 wt.-% of the earth's crust is made up of lattices containing tetrahedral ions. H. J. E.

Action of sulphide minerals on solutions of gold chloride and cyanide. O. E. ZVJAGINTZEV and E. L. PISARSHEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 435—436).—Aq. $HAuCl_4$ (0·1690 g. of Au in 100 ml.) was reduced rapidly at 20° by pyrite (I) and chalcopyrite (II) and more slowly by halenite and sphalerite. Reduction of aq. $KAu(CN)_2$ was much slower, but (I) and (II) were again the more active. H. J. E.

Sapropelic deposits in the Coorong region of S. Australia. (SIR) D. MAWSON (Inst. Petroleum Conf., June, 1938, 3 pp.).—Coorongite consists of the accumulated remains of microscopic pond life, chiefly of the alga *Botryococcus Braunii*. Two other forms of algal deposits recently discovered are described. The second of these is a gelatinous, rubber-like material—an algal gel of a type low in oil-yielding qualities. An analysis is recorded. L. S. T.

Effect of lattice discontinuities on the magnetic properties of magnetite.—See A., 1938, I, 390.

Tengerite found in Iisaka. T. IIMORI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 832—841).—The material, which occurs as a white powder in cavities of a reddish-brown mineral related to garnet, embedded in felspar, or else as incrustations on a felspar or yttrialite surface, has the approx. composition $3Y(OH)CO_3,CaCO_3,3H_2O$. It may be

formed by reaction of a Ca salt with a solution of an alkali Y carbonate, produced from yttrialite by weathering, the resulting Y Ca carbonate being insol. R. C. M.

Hypersthene from Japan. H. KUNO (Proc. Imp. Acad. Tokyo, 1928, **14**, 218—220).—Hypersthene crystals in dacite-pumice from the Hakone volcano gave SiO_2 53·24, TiO_2 0·23, Al_2O_3 1·38, Fe_2O_3 1·05, FeO 18·70, MnO 0·85, MgO 23·34, CaO 1·23, Na_2O, K_2O, P_2O_5 traces, H_2O 0·10 = 100·12. This composition and the optical data (α 1·691, β 1·701, γ 1·705, 2V 60°) are compared with previous plots (A., 1935, 1344; 1936, 185). L. J. S.

Primary cummingtonitic hornblende from dacites in Japan. H. KUNO (Proc. Imp. Acad. Tokyo, 1938, **14**, 221—224).—Cummingtonitic hornblende does not appear to have been previously recorded in an undoubted igneous rock. Optical data are given of colourless crystals with a marginal zone of common green hornblende. When heated at 750°, this material changes into basaltic hornblende. L. J. S.

Heavy minerals from crystalline rocks in the region between Passau and Cham. G. CLAUS (Neues Jahrb. Min., 1936, **71**, 1—58; Chem. Zentr., 1936, ii, 1138—1139).—The minerals are described. Zircon and monazite are the chief of the heavy minerals. H. J. E.

Isogonal combination in the barytes type. H. BERGHEIMER (Zentr. Min., 1936, **A**, 101—109; Chem. Zentr., 1936, ii, 768—769). H. J. E.

Manganese-bearing amphiboles of Praborna (San Marcel, Valle d'Aosta). R. RONDOLINO (Period. Min., 1936, **7**, 109—121; Chem. Zentr., 1936, ii, 769).—The mineral, containing approx. 7% of Mn and no Fe^{II}, is described. H. J. E.

Ankerite and cosalite from Vaskö. L. TOKODY and G. VAVRINECZ (Föld. Közlöny, 1935, **65**, 301—305; Chem. Zentr., 1936, ii, 769). H. J. E.

Artinite from the Cogne mines (Valle d'Aosta). M. FENOGLIO (Period. Min., 1936, **7**, 47—57; Chem. Zentr., 1936, ii, 769).—The analytical data are represented by $MgCO_3,Mg(OH)_2,3H_2O$. An identity period of 3·14 A. was detected by *X*-ray measurements. H. J. E.

Augite from Vesuvius. II. K. MÜLLER (Zentr. Min., 1936, **A**, 116—122; Chem. Zentr., 1936, ii, 769).—Augite from 1929 lava has the composition $74SiO_2,6Al_2O_3,4Fe_2O_3,6FeO,30MgO,37CaO,2TiO_2$, with traces of K_2O and Na_2O. H. J. E.

Gadolinite crystals from Ytterby. L. O. MARTIN (Geol. Fören. Stockholm Förhandl., 1936, **58**, 344—348; Chem. Zentr., 1936, ii, 769).—Crystallographic measurements are recorded. H. J. E.

Baveno granite mica. P. GALLITELLI (Period. Min., 1936, **7**, 61—76; Chem. Zentr., 1936, ii, 769).—Analytical and crystallographic data are recorded. H. J. E.

Isomorphous layer formation in corundum and its significance for differentiating between synthetic and natural corundums. A. SCHRÖDER (Zentr. Min., 1936, **A**, 129—135; Chem. Zentr., 1936, ii, 769).—Goniometric measurements are given. H. J. E.

Region with indications of useful minerals. Poggio S. Vicino (formerly Ficano), Macerata Province, Upper Esino Valley, Torrente della Mola. G. DE A D'OSSAT (Ric. sci. Progr. tecn., 1936, [ii], **7**, I, 56; Chem. Zentr., 1936, ii, 770). H. J. E.

Ores of the nickel and cobalt veins of Arburese (Sardinia). G. DESSAU (Period. Min., 1936, **7**, 21—39; Chem. Zentr., 1936, ii, 771).—The ores are described. H. J. E.

Phenacite, its morphology and paragenesis. F. H. POUGH (Jahrb. Min. Beil.-Bd., 1936, **A**, **71**, 291—341; Chem. Zentr., 1936, ii, 2116).—Phenacite forms trigonal rhombohedral crystals; a no. of specimens from different sources are described, and their paragenesis is discussed. Phenacite is probably characteristic of the later stages of pegmatite formation, being stable at lower temp. than beryl. It is also characteristic of hydrothermal processes. A. J. E. W.

Orthoclase twins and the Karlsbad law. H. TERTSCH (Zentr. Min., 1936, **A**, 198—207; Chem. Zentr., 1936, ii, 2116).—Twin formation according to the Karlsbad law in orthoclase in which the (001) and ($\bar{1}$01) faces predominate occurs with growth faces parallel to the (010) plane. When the (001) and ($\bar{2}$01) faces predominate overlapping of the twin components occurs. The difference is ascribed to differing viscosity of the mother-liquors, low viscosity favouring growth parallel to the (010) plane. A. J. E. W.

Rod-shaped clay particles. G. NAGELSCHMIDT (Nature, 1938, **142**, 114).—Pyrophyllite crystals from Tres Cerritos, Sierra Nevada, California, form long, thin rods radiating outwards from the centres of spheres. *X*-Ray single crystals reflexions with a period of 5·1 A. for the needle axis have been obtained. L. S. T.

Crystal structures of the clay mineral hydrates. S. B. HENDRICKS (Nature, 1938, **142**, 38).—Hydrates such as vermiculite, hydrated halloysite, and probably montmorillonite, contain layers of H_2O as hexagonal networks interleaved with the silicate structure. L. S. T.

What does the attackability of clay by hydrochloric acid signify? W. L. E. DE KEYSER (Natuurwetensch. Tijds., 1938, **20**, 137—141).—For very pure clays, *e.g.*, kaolin and fireclays, there is a very close relationship between the amount of Al_2O_3 dissolved by HCl and the fineness (% <0·5 μ.) of the sample, but this relationship is less obvious with impure clays. In no case is it possible to use the extraction method for the determination of allophanoids. S. C.

Conditions of deposition of the oil shales and cannel coals of Scotland. M. MACGREGOR (Ints. Petroleum Conf., June, 1938, 12 pp.).—Distribution of the shales and coals, the nature of the sediments associated with them, and the conditions of deposition are discussed. L. S. T.

Dielectric constant and conductivity of soil at high radio frequencies.—See A., 1938, I, 388.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

OCTOBER, 1938.

Band spectrum of helium. S. P. McCallum and M. S. Wills (Nature, 1938, **142**, 252—253).—Band spectra of a discharge in He at 27·5 mm. pressure obtained under different excitation conditions indicate that He mols. formed in the discharge have a life ~1/600 sec. or, more probably, that they are formed by the collision of metastable with neutral atoms after interruption of the discharge. L. S. T.

Band spectra of nitrogen forming a Rydberg series. T. Takamine, T. Suga, and Y. Tanaka (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 854—864).—The absorption bands of N_2 forming a Rydberg series have been studied. An emission band, which is also visible, forms a Rydberg series converging to the same limit as that of the absorption bands, viz., 661·2 A., corresponding with the $A^{12}\Sigma_u^+$ state of N_2. W. R. A.

Identification of aurora radiations. J. Kaplan (Z. Physik, 1938, **108**, 744—749).—Certain auroral lines can be identified with single-headed members of the $A^3\Sigma \rightarrow X'\Sigma$ series (the so-called ε system) of gaseous N_2 within the limits of experimental error, whereas Vegard's identification of the lines with double-headed members of the ε system of solid N_2 is less precise and erroneously suggests the presence of solid N_2 in the auroral region. H. C. G.

Excitation of the aurora spectrum in the laboratory. J. Kaplan (Z. Physik, 1938, **109**, 750—752).—See following abstract. H. C. G.

Auroral afterglows. J. Kaplan (Physical Rev., 1938, [ii], **54**, 176—178).—The prep. of auroral afterglows in pure N_2 is discussed in detail. A nomenclature for the five stages most frequently met in the prep. of these glows and normally occurring in the order O_3, NO, CN, Lewis–Rayleigh, and auroral stages is introduced. N. M. B.

Production of highly vibrating molecules. J. Kaplan (Physical Rev., 1938, [ii], **54**, 230).—First positive N_2 bands originating on very high vibrational levels and occurring in the spectrum of the auroral afterglow have been photographed in the spectrum of a new high-pressure afterglow. The enhancement of the bands is shown and contrasted with the Lewis–Rayleigh glow. N. M. B.

Colour of the nocturnal sky. R. Grandmontagne (Compt. rend., 1938, **207**, 275—277).—The mean energy radiated by the nocturnal sky in the spectral bands 5800—6550, 6550—7000, and 7000—9000 A. is 6·50, 3·56, and 11·25 arbitrary units, respectively. The energy vals. undergo diurnal and seasonal variations, but the spectral energy distribution remains approx. const. A. J. E. W.

Band spectrum of the ionised oxygen molecule. L. Bozóky (Math. nat. Anz. ung. Akad. Wiss., 1936, **54**, 557—585; Chem. Zentr., 1936, ii, 1118).—The spectrum was photographed with an improved source and high dispersion. The following consts. were redetermined: $A^2\Pi B_e = 1{\cdot}070$, $\alpha = 0{\cdot}022$; $X^2\Pi B_e = 1{\cdot}668$, $\alpha = 0{\cdot}019$. H. J. E.

Broadening and displacement of the higher series sodium lines through cæsium vapour. C. Füchtbauer and G. Heimann (Z. Physik, 1938, **110**, 8—20).—The broadening of certain Na lines due to admixture of Cs with the emitting Na vapour is measured. The effect is large and comparable with the Cs/Cs broadening; it indicates an unusually great action cross-section for the Cs atom. The displacements are all towards the red and from them the action cross-section of Cs towards slow electrons is obtained as $25{\cdot}9 \times 10^3$ sq. cm. per c.c. at 1 mm. pressure. L. G. G.

Moments and abundances of the atomic nuclei $^{171}_{70}$Yb and $^{173}_{70}$Yb. H. Schüler and J. Roig (Naturwiss., 1938, **26**, 495).—The classification of the Yb lines in a term-scheme by Meggers *et al.* (A., 1938, I, 108) makes it possible to determine the moments of $^{171}_{70}$Yb and $^{173}_{70}$Yb from the hyperfine structure of the lines. Transitions between the terms $(4f^{14}6s^2)^1S_0$, $(4f^{14}6s7s)^3S_1$, and $(4f^{14}6s6p)^3P_{0,1,2}$ were investigated. The mechanical moments of $^{171}_{70}$Yb and $^{173}_{70}$Yb are 1/2 and 5/2, respectively, this being the first example where the mechanical moments of two isotopes differ by two units. The abundance ratio ^{173}Yb/^{171}Yb is 1·13 (cf. Aston, A., 1934, 341). The magnetic moment of $^{171}_{70}$Yb is positive and about as large as that of $^{199}_{80}$Hg. $^{173}_{70}$Yb has a negative magnetic moment and a large positive quadrupole moment. A. J. M.

Spectrum of neutral iridium, Ir I. W. Albertson (Physical Rev., 1938, [ii], **54**, 183—184).—From new data in the range 4627—2159 A., intensities, λλ, and classifications of the most intense lines are tabulated. The normal electron configuration of Ir I is $5d^76s^2$ and the ionisation potential is ~9·2 v. N. M. B.

Atom factor of thallium. J. Palacios and J. Losada (Congr. int. Quim. pura apl., 1934, **9**, II, 165—171; Chem. Zentr., 1936, ii, 2293).—The at. form factor is calc. from *X*-ray powder photographs of TlCl. A. J. E. W.

Extension of *X*-ray spectra towards optical radiation. M. SIEGBAHN (Nuovo Cim., 1938, **15**, 115—116).—A summary. O. J. W.

Absolute wave-length determination of the Al $K\alpha_{1,2}$ line with a concave grating. F. TYRÉN (Z. Physik, 1938, **109**, 722—727).—The λ of the Al $K\alpha_{1,2}$ line measured with a concave-grating spectrograph at grazing incidence is 8·3397±0·0003 A. Combining this with the lattice const. of calcite the val. of the electronic charge is 4·803±0·004 e.s.u. L. G. G.

Rontgen lines of the *M* series of ^{48}Cd to ^{58}Ce. H. KIESSIG (Z. Physik, 1938, **109**, 671—684).—Lines of the *M* series for elements ^{48}Cd to ^{58}Ce were photographed with a plane-grating spectrometer and the data arranged in a Moseley diagram. Two new Moseley lines were found and ascribed to the transitions $M_{IV}O_{II}$ and $M_{V}O_{III}$. An $M\alpha\beta$ doublet was found with ^{57}La. New energy level vals. are calc. Measurements of the half-width vals of $M\varepsilon$ lines show a definite relationship with the periodic system. H. C. G.

***X*-Ray spectra. II. Comparison of the spectra of tungsten and platinum in the first and second orders.** F. VIERHELLER and J. A. SARALEGUI (Strahlenther., 1934, **51**, 704—713; Chem. Zentr., 1936, ii, 2088).—The relation between the first-order spectra is in accord with the at. nos. The line spectra become more complex in the second order. A classification of lines in the neighbourhood of the α-, β-, and γ-lines is attempted. A. J. E. W.

Excitation of metastable atoms in a gas discharge. V. FABRIKANT (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 385—388).—In the discharges in Hg rectifiers the excited atoms constitute about 10% of the total and have a Boltzman distribution. At the initial moment (stationary discharge) the excited atoms are distributed over the discharge section according to Bessel's function and not uniformly (cf. Meissner and Graffunder, A., 1928, 212), and an exponential abatement in concn. occurs with time. F. J. L.

Effect of magnetic field on mercury discharge radiation. V. FABRIKANT and G. ROCHLIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 393—396).—The effect of the magnetic field produced by two solenoids on the luminous discharge from a low-pressure, H_2O-cooled, liquid-cathode Hg lamp is investigated. The luminosity of the positive column is little affected by a longitudinal homogeneous field, but a non-homogeneous field increases the intensities of the lines λλ 5461, 5770—5791 A. 6—7 times and of the resonance lines λλ 1850 and 2537 A. 2—5 times. The magnetic field causes distortions of the electron paths and increases the no. of collisions between atoms and electrons. F. J. L.

Influence of ultrasonic waves on the discharge potential of hydrogen. R. PIONTELLI (Atti R. Accad. Lincei, 1938, [vi], **27**, 357—363).—The influence of ultrasonic waves on the current–potential curves at smooth Pt cathodes in 0·1N-HCl, -KCl, and -NaOH has been studied at 25°. The ultrasonics bring about a strong depolarisation, which is about 0·8 v. at the lowest c.d. and decreases with increasing c.d. The bearing of the results on modern theories of overvoltage is discussed. O. J. W.

Generalisation of the theory of electrical discharges. J. S. TOWNSEND and E. W. B. GILL (Phil. Mag., 1938, [vii], **26**, 290—311).—The theory is extended to cover discharges in gases at low pressure and under the influence of magnetic field. O. D. S.

Excitation of radiating atoms in a gas discharge. V. FABRIKANT. (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 389—392).—Theoretical calculations of the concns. of excited radiating atoms based on the analogy between the diffusion of quanta and atoms suggested by Compton (Physical Rev., 1922, **20**, 283). F. J. L.

Ionisation of air by *X*-rays of varying hardness and degree of homogeneity up to 400 kv. in cylindrical chambers with diameter up to 70 cm. W. I. BLOCK (Am. Physik, 1938, [v], **32**, 701—733).—An extension of the investigation of Küstner (A., 1931, 994) for *X*-rays of higher energy. The variation in sharpness and intensity of *X*-ray beams of 220 and 400 kv. energy at various depths in H_2O have been investigated by means of a small chamber. O. D. S.

Secondary emission of beryllium. E. G. SCHNEIDER (Physical Rev., 1938, [ii], **54**, 185—188; cf. A., 1938, I, 3).—As the deposition of Be film, by evaporation in vac., proceeds, the secondary emission ratio rises from that of the support metal to about 2·5 and then falls to <1, whilst the voltage of the primary electrons necessary to reach the max. drops to about 200 v. Heating the thick Be to bright redness for a few min. raises the emission to about 1·6 with the max. at a primary energy of about 630 v. Surface oxidation increases the emission to about 4·1. Explanations of these effects are discussed and evidence is given that the max. secondary emission ratio for pure bulk Be is 1·6. N. M. B.

Emission of protons from hydrogenated palladium. T. FRANZINI (Nuovo Cim., 1938, **15**, 88—99).—The emission of positive and negative particles from Pd saturated with H_2 has been studied for the temp. range 100—1250°. Expressions are given showing the variation with temp. of (*a*) the velocity of thermal emission of electrons from pure Pd, (*b*) the velocities of thermal emission of electrons and of protons from Pd saturated with H_2, and (*c*) the velocity of diffusion of H_2 through Pd. The results show that the H emitted by Pd is partly in the form of protons. O. J. W.

Determination of e/m for electrons. A. E. SHAW (Physical Rev., 1938, [ii], **54**, 193—209).—A new precision method utilising the good focussing properties of crossed electric and magnetic fields (cf. A., 1934, 233) is described. The final equation for e/m does not involve the velocity explicitly and focussing criteria eliminate the markedly error-inducing influence of electron velocity. The val. of e/m is $(1{\cdot}7571\pm0{\cdot}0013)\times10^7$ e.m.u. The limitations imposed by the design of the condenser are discussed. N. M. B.

Atomic electron velocities in hydrogen. A. L. HUGHES and (MISS) M. A. STARR (Physical Rev., 1938, [ii], **54**, 189—193; cf. A., 1938, 109).—The relation of the inelastic scattering of fast electrons by gases to the distribution of velocities among the at. electrons is discussed. A beam of electrons of energy 1737—4040 v. was directed into H_2 at low pressure and from measurements of the distribution of energies among those electrons scattered at 34·2° the distribution of component velocities among the at. electrons was found. The experimental curve is wider by about 11% at half-width than the curve computed by Hicks (cf. A., 1937, I, 590). In view of exact agreement for He, the theory in the case of H_2 probably needs revision. N. M. B.

Velocity distribution of elastically colliding electrons in a gas with molecules executing thermal movements. R. LICHTENSTEIN (Physikal. Z., 1938, **39**, 646—656).—Theoretical. The velocity distribution of electrons which suffer elastic collisions with the mols. of a gas executing thermal movements is calc. when the electrons are under the influence of a homogeneous electric field. The velocity distribution of rapid electrons is determined by the thermal movements of the mols. A. J. M.

Electronic space charge with homogeneous initial electron velocity between plane electrodes. M. J. O. STRUTT and A. VAN DER ZIEL (Physica, 1938, **5**, 705—717). H. J. E.

Spontaneous electron emission from electrodes and the field electron emission from thin layers of insulators as an after-effect of the discharge through gases. H. PAETOW (Naturwiss., 1938, **26**, 497).—When the discharge in a tube is switched off a stream of electrons continues to flow from the cathode, the val. of this current decreasing with time, and being ∝ product of the time for which the discharge took place and the current strength up to a saturation val. The effect has its origin in surface and adsorption layers as it disappears if the electrodes are pure, or if they are preheated. Different gases exert different effects on the surface layers, *e.g.*, only He and Ne could induce the effect in O_2 layers, showing that in the discharge in He and Ne photons of greater energy than in other gases occur. By the addition of impurities, *e.g.*, MgO, to the electrodes the after-current could be increased to 10^{-9} amp. If the MgO or other insulator is separated from the metal electrode by a semi-conducting layer, electrons of energy >20 e.v. are emitted. The excitation is caused by photons. With a homogeneous layer of Al_2O_3 on Al, however, a greater excitation is produced by ions than by photons. A. J. M.

Influence of adsorbed films on the liberation of electrons and the reflexion of ions from tungsten bombarded by positive cæsium ions. H. PAETOW and W. WALCHER (Z. Physik, 1938, **110**, 69—83).—The no. of electrons liberated from W surfaces by bombardment with positive Cs ions is greatly increased by the presence of adsorbed films. Such films also have a considerable effect on the reflexion of ions. The mechanism of these phenomena is discussed and the reflexion process compared with surface ionisation. H. C. G.

Spin phenomena and limiting conditions. F. MÖGLICH (Z. Physik, 1938, **110**, 1—7).—Mathematical. The directional quantisation of an electron can be calc. without employing the matrix of Dirac and Pauli. H. C. G.

Production of positrons in the passage of fast β-particles through matter. H. STAUB (Helv. Phys. Acta, 1936, **9**, 306—316; Chem. Zentr., 1936, ii, 933—934).—From Wilson chamber measurements the effective cross-section for such a process is $<5 \times 10^{-24}$ sq. cm., as is required by theory. H. J. E.

Production of positron–electron pairs during the passage of β-particles through matter. N. FEATHER and J. V. DUNWORTH (Proc. Camb. Phil. Soc., 1938, **34**, 435—441).—The production of positron–electron pairs by high-energy β-particles from a source of U-*X* in absorbers of Al, Pb, and brass is investigated by recording the simultaneous emission of the pairs of oppositely directed quanta which are produced when positrons, having already lost all their energy in ionisation, finally suffer annihilation. F. J. L.

Slow positive rays. A. ROSTAGNI (Nuovo Cim., 1938, **15**, 117—120).—A summary of previous work. O. J. W.

Anomalous scattering of α-particles and long-range nuclear forces. H. S. W. MASSEY and C. B. O. MASSEY (Proc. Camb. Phil. Soc., 1938, **34**, 498—501).—The anomalous scattering of α-particles in H_2, D_2, and He revealing appreciable deviations from Coulomb's law cannot be explained by the electrostatic polarisation of the colliding nuclei due to their electric charges. F. J. L.

Equilibrium state between large ions and ions produced in a gas by *X*-rays. O. TE-TCHAO and (MLLE.) A. M. MOULIN (Compt. rend., 1938, **206**, 1464—1466).—The production by *X*-rays of large positive and negative ions in a current of air containing smoke particles has been investigated. The relation between the no. of ions produced and the ionisation intensity is discussed. A. J. E. W.

Townsend ionisation number, γ, and its relation to field intensity. R. SCHÖFER (Z. Physik, 1938, **110**, 21—36).—Discharge initiation potentials in A with various electrodes under different conditions have been measured in order to determine γ, which was also calc. from the decrease in initiation potential resulting from incident radiation. The two methods give concordant results. H. C. G.

Striated positive column. I. Pure hydrogen. A. GÜNTHER-SCHULZE and H. MEINHARDT (Z. Physik, 1938, **110**, 95—117; cf. A., 1938, 378).—The c.d. at which the non-striated discharge changes into the striated form can be measured accurately and is an exponential function of the pressure. The formation of discrete pairs of striæ and the various phases of the discharge are discussed. H. C. G.

Influence of the Ramsauer effect on the potential gradient in a positive column. B. KLARFELD (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 471—

473; cf. Groos, A., 1934, 711).—In the pressure range 0·001—10 mm. Hg, potential gradient–p curves have been recorded by a probe method for discharges in He, Ne, A, and Kr, and in K and Hg vapours. Where a Ramsauer effect exists (Kr, A, Ne, and possibly Hg) the curves show a min. Agreement with theory is qual. I. McA.

Nuclear law of 4 and isotopy of the elements. Structure of the nucleus of atoms. III. G. Oddo (Gazzetta, 1928, **68**, 352—359; cf. A., 1933, 996).—For the 20 most abundant elements in the earth's crust the relative abundances of isotopic masses corresponding with $4n$, $4n+1$, $4n+2$, and $4n+3$ are 82·23, 2·28, 1·81, and 12·17%, respectively. The five elements F, Na, Al, P, and Mn, which have no isotopes, all have at. wts. corresponding with $4n+3$. Isotopes of mass $4n+2$ are apparently least stable. This rule holds also for the less abundant elements, although not so strikingly. O. J. W.

Isotopes of potassium. A. K. Brewer (Ind. Eng. Chem., 1938, **30**, 893—896).—A type of Geiger counter suitable for the measurement of radioactivity of K, and a mass-spectrograph for the estimation of the no. and abundance of isotopes, are described. The approx. proportions are ^{39}K 8300, ^{40}K 1, ^{41}K 585. Ratios ^{39}K/^{41}K for K from various sources are tabulated. In general plant tissues have the ratios for the soil in which they grow but kelp and seaweeds are exceptions. Animal tissues show marked selectivity. The only radioactive isotope is ^{40}K. Its disintegration const. is computed. The combined disintegration steps are $^{40}_{19}\mathrm{K} \rightarrow {}^{40}_{20}\mathrm{Ca} + \beta$, $^{40}_{19}\mathrm{K} + e \rightarrow {}^{40}_{18}\mathrm{A} + \gamma$. The relative rates of production of ^{40}Ca to ^{40}A should be equal to the ratio of β- to γ-rays or 100 : 1. This is about the ratio in the earth's crust. It seems probable that most if not all the ^{40}Ca and ^{40}A in the earth's crust results from ^{40}K decay. C. I.

Mass number of stable isotopes of elements 43, 61, 85, and 87. R. Grégoire (Compt. rend., 1938, **206**, 1477—1478).—The following mass nos. are deduced from a consideration of the stable isotopes of neighbouring elements: element 43, 97 and 99; element 61, 145, 147, and possibly 149; element 85, 213, 215, and possibly 217; element 87, 219 and 221. If elements 85 and 87 form part of a disintegration series commencing with U, the parent element must be a hitherto unknown isotope of mass no. 231, 233, or 237. A. J. E. W.

Probable existence of element 93 in the natural state. H. Hulubei and (Mlle.) Y. Cauchois (Compt. rend., 1938, **207**, 333—335).—X-Ray emission lines at 886, 696, 734, and 596 X, which are identified with the $L\alpha_1$, β_1, β_2 and γ_1 lines of element 93, respectively, have been observed on examination of minerals containing U and Re. The intensity of the lines increases on chemical concn. of the Re, confirming the presence of an analogous element. A. J. E. W.

Existence of hitherto unknown natural α-radiation. J. Schintlmeister (Sitzungsber. Akad. Wiss. Wien, 1935, II*a*, **144**, 475—487; Chem. Zentr., 1936, ii, 1115).—α-Rays of range ~2·1 cm. have been reported, but their source is unknown. They are always associated with Sm. Ga, Ge, In, Tl, Se, and P were shown to be inactive, and the activity may be due to Tu or to element 61. H. J. E.

Variation of ionisation with range of α-particles, protons, deuterons, and ^{3}H particles. J. C. Bower (Proc. Camb. Phil. Soc., 1938, **34**, 450—458).—The positions of max. ionising efficiency for single α-particles, protons, deuterons, and ^{3}H particles have been determined by photometric measurement of the variation of density along photographs of expansion chamber tracks to be 2·78, 0·78, 1·47, and 2·39 mm., respectively. F. J. L.

Method of determining the degree of dependence of the disintegrations of polonium atoms. M. Ferber (Compt. rend., 1938, **207**, 336—337).—A theoretical discussion of oscillographic records of α-particle emission from Po. A. J. E. W.

Radioactive recoil in the preparation of thorium-C''. V. Majer (Coll. Czech. Chem. Comm., 1938, **10**, 236—241).—Examination by the Geiger–Müller counter of the decay of Th-C'' (half-life 3·2 min.), obtained from the active deposit of Th by recoil, shows the presence of Th-C (60 min.), Th-B (10·6 hr.), and also 10% of Th-X (87·4 hr.); the observed effects are attributed to the formation of at. aggregates. K. W. P.

β-Rays from radium-E. B. T. Wright and A. W. McReynolds (Physical Rev., 1938, [ii], **54**, 231).—The emission of heavy electrons from Ra-E as reported by Jauncey (cf. A., 1938, I, 111) is investigated. When ebonite screens are placed between the condenser plates electrons scattered from the plates are eliminated as suggested by Compton (cf. *ibid.*, 224). N. M. B.

Total energy of the γ-radiation emitted from the active deposit of actinium. (Miss) E. Kara-Michailova (Proc. Camb. Phil. Soc., 1938, **34**, 429—434).—The total energy emitted in the form of γ-radiation from Ac-B + C is determined by measuring the ionisation produced relative to that of a Ra-C and Th-B + C γ-radiation after absorption in various thicknesses of Pb from 0 to 2 cm. F. J. L.

β-Rays of actinium-B and -C'' partial spectra. B. W. Sargent (Physical Rev., 1938, [ii], **54**, 232).—The end points of the β-rays of Ac-B and Ac-C'', determined with increased precision by an absorption method, are 1·40 and 1·47 Mc.v., and the ranges 0·64 and 0·68 g. per sq. cm. of Al, respectively. Intensities, constitutions, and transformations are discussed, and the relative importance of the use of max. instead of average energies is examined. N. M. B.

Scattering of D–D neutrons. S. Kikuchi and H. Aoki (Sci. Papers Inst. Phys. Chem. Tokyo, 1938, **34**, 865—872).—The scattering cross-sections (I) of 21 elements for D–D neutrons have been measured by an apparatus which is described. The data obtained indicate that I is a regular function of the at. no. having max. and min. This is in contradiction to the conclusion of Dunning (A., 1935, 1186). W. R. A.

Diffusion properties of slow neutrons. E. Amaldi and E. Fermi (Ric. sci. Prog. tec., 1936, [ii], **7**, I, 393—395; Chem. Zentr., 1936, ii, 2086).—The

mean free path for *D*- and *A*-group neutrons (cf. A., 1938, I, 427) is corr. to ~1·1 cm.; the val. for the *C*-group, the determination of which is described, is 0·275 cm. The cross-sections for elastic collision with H and for capture are 4·8 and $0·32 \times 10^{-24}$ sq. cm., respectively. The mean life period is $1·6 \times 10^{-4}$ sec. A. J. E. W.

Interaction of fast neutrons with atomic nuclei. A. Soltan (Nature, 1938, **142**, 252).—Measurements of the absorption of neutrons (deuteron bombardment of Li) by various substances indicate that for heavy nuclei, at least, the sticking probability is <1, *i.e.*, a fast neutron may fall on a nucleus without sticking to it and without changing its direction to any great extent. L. S. T.

Distribution of resonance levels from the excitation of nitrogen by fast neutrons. J. Thibaud and P. Comparat (Compt. rend., 1938, **207**, 226—228; cf. A., 1938, I, 427).—Resonance levels are observed with energies of 0·85, 1·02, 1·30, 1·60, 1·75, 2·05, 2·25, 2·55, 2·75, 3·05, and 3·30 Me.v. H. J. E.

Artificial α-radioactivity. R. Döpel (Verh. phys.-med. Ges. Würzburg, 1936, **59**, 78—79; Chem. Zentr., 1936, ii, 2287—2288).—Artificial α-radioactivity with a decay period of several min. has been observed in Ce, Cs, and In after neutron bombardment. This shows, in agreement with Gamow's theory, that no fundamental distinction exists between spontaneous and artificially excited α-particle emission. A. J. E. W.

Detection of α-rays during the irradiation of thorium and uranium with radium–beryllium neutrons. G. F. von Droste (Z. Physik, 1938, **110**, 84—94).—An ionisation chamber is described which in combination with a valve amplifier can detect α-particles in the presence of Ra, γ-rays being separated by means of a W filter. Within experimental error of the counter no (n, α) process occurs with Th or U. L. G. G.

Yield of α-particles from beryllium bombarded by protons. G. T. Hatch (Physical Rev., 1938, [ii], **54**, 165—171; cf. A., 1938, I, 7).—Experiments to determine the excitation function of the reaction $^{9}_{4}\mathrm{Be}(p, \alpha)^{6}_{3}\mathrm{Li}$ for proton energies ≯400 kv. are described. The yield is of the order 4×10^{-6} α-particle per proton at 400 kv., but the derived thin target curve shows a marked flattening from the exponential form observed at lower voltages. Above 300 kv. the cross-section is nearly const. at about $2·3 \times 10^{-25}$ sq. cm. N. M. B.

Energy change in the transmutation of beryllium into lithium by proton bombardment. S. K. Allison, L. S. Skaggs, and N. M. Smith, jun. (Physical Rev., 1938, [ii], **54**, 171—175; cf. preceding abstract).—Since the α-particle yield from the reaction $^{9}_{4}\mathrm{Be}(p, \alpha)^{6}_{3}\mathrm{Li}$ is very high, energies were measured with high precision by deviating a beam of α-particles through 90° by means of a steady source of high voltage which could be measured to 0·1% up to 40 kv. Be was bombarded by 320- and by 383-kv. protons. The energy distribution curves of the α-particles show a sharp high-energy limit increasing with proton energy. The energy balance of the reaction is 2·152±0·04 Me.v., corresponding with $2·310 \pm 0·04 \times 10^{-3}$ at. wt. unit. The difference in mass of ^{9}Be and ^{6}Li is thus 2·99804±0·00009. Assuming the val. 6·01686±0·00020 for ^{6}Li, the mass of ^{9}Be is 9·01491±0·00025. N. M. B.

Beryllium isotope of mass 8. O. Laaff (Ann. Physik, 1938, [v], **32**, 743—760).—An amplifying circuit is described for the quant. measurement of the ionising power of single fast nuclear fragments. The ^{8}Be nucleus produced by the process $^{11}\mathrm{B}(p, \alpha)^{8}\mathrm{Bo}$ disintegrates into two α-particles detected by their simultaneous entry into the ionisation chamber. It is calc. that the energy of disintegration is < 0·2 Me.v. Discrepancies from the theoretical vals. for the spatial distribution of the liberated α-particles were observed. O. D. S.

Absorption and coincidence experiments on the radiations from radioactive sodium, ^{24}Na. N. Feather and J. V. Dunworth (Proc. Camb. Phil. Soc., 1938, **34**, 442—449).—The energy spectrum of the β-particles from ^{24}Na is simple and continuous with an upper limit at $1·40 \times 10^{6}$ e.v., but many of the β-particles are not time-correlated with the γ-ray emission, although almost all γ-ray quanta occur "simultaneously" with β-emission. F. J. L.

Radiosilicon produced by bombardment of sulphur with fast neutrons. J. Cichocki and A. Soltan (Compt. rend., 1938, **207**, 423—425).—Periods of 14·5 days (cf. A., 1937, I, 490) and ~2·6 hr. are observed on bombardment of S with 13·5 Me.v. neutrons. The 2·6-hr. period is associated with Si in chemical separations, confirming that it is due to $^{31}\mathrm{Si} : {}^{34}_{16}\mathrm{S} + {}^{1}_{0}n \rightarrow {}^{31}_{14}\mathrm{Si} + {}^{4}_{2}\mathrm{He}$. The exact period (157·3±1·3 min.) is in agreement with that of ^{31}Si formed by a (n, p) reaction from ^{31}P (156·9±1·6 min.). ^{30}P produced by a $(n, 2n)$ reaction has a period of 130·6±1·5 sec. A. J. E. W.

Radioelement produced in cadmium under the action of fast neutrons. M. Dodé and B. Pontecorvo (Compt. rend., 1938, **207**, 287—289).—A radioelement of period 50±5 min. has been produced by bombarding Cd with neutrons from a Rn–Be source. Its radiation is of high intensity but very low penetrating power. Chemical separations show that the element is probably a Cd isotope, possibly corresponding with a metastable state to which the atom returns after excitation without neutron capture; γ-rays or conversion electrons are emitted on reversion to the fundamental state. A. J. E. W.

Disintegration of boron with emission of deuterons. I. Zlotowski (Compt. rend., 1938, **207**, 148—150).—In the disintegration of B with Po α-particles 4 $^{2}_{1}$D and 270 $^{1}_{1}$H tracks were observed (A., 1938, 1, 290). Repetition of the experiment with higher-energy α-particles (5·15 instead of 4·8 Me.v.) gives 147 $^{1}_{1}$H and 6 $^{2}_{1}$D tracks. Of the 10 $^{2}_{1}$D particles 8 have energies between 3·65 and 4·05 Me.v. and the other 2 between 4·81 and 5·20 Me.v. The probabilities of the occurrence of the alternative disintegrations $^{10}_{5}\mathrm{B} + {}^{4}_{2}\mathrm{He} \rightarrow {}^{12}_{6}\mathrm{C} + {}^{2}_{1}\mathrm{D} + 1·39$ Me.v. (*a*) or ${}^{13}_{6}\mathrm{C} + {}^{1}_{1}\mathrm{H} + 4·30$ Me.v. (*b*) are discussed; (*b*) is 40 times as probable as (*a*). W. R. A.

Disintegration of nitrogen by neutrons. G. KIRSCH and F. RIEDER (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, **144**, 383—392; Chem. Zentr., 1936, ii, 935).—The Wilson chamber photographic method was employed. Two processes are associated with the capture of neutrons. In one ^{11}B is produced by emission of an α-particle, and in the other, which is less frequent and mainly due to faster neutrons, a proton is emitted and ^{14}C produced. The energy relationships lead to the expectation of a long life for the products. H. J. E.

Disintegration of aluminium, examined by the photographic method. E. STEPPAN (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, **144**, 455—474; Chem. Zentr., 1936, ii, 937).—Proton groups of range 17, 22, 25, 28, 41, 46, 50, and 56 cm. at 15° were detected. The energy relationships are discussed. H. J. E.

Disintegration of elements from argon to manganese with polonium α-rays. J. SCHINTLMEISTER and E. FÖYN (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, **144**, 409—418; Chem. Zentr., 1936, ii, 935; cf. A., 1936, 1045).—Of the elements A, K, Ca, Sc, Ti, V, and Mn, only K gave an appreciable yield of H particles. The remainder gave $\geqslant 0{\cdot}2$ H particle per 10^6 Po α-particles. H. J. E.

Nuclear photo-effect with γ-rays from ^{11}B (p, γ). W. GENTNER and W. BOTHE (Naturwiss., 1938, **26**, 497—498).—Artificial radioactive nuclei (^{13}N, 11 min.; ^{34}Cl, 33 min.; ^{39}Ca, 4·5 min.; ^{62}Cu, 10·5 min.; ^{63}Zn, 38 min.; ^{106}Ag, 24 min.; ^{108}Ag, 2·3 min.; Sb, 15 min.) have been produced by the nuclear photo-effect using γ-rays from ^{11}B obtained by bombarding B with protons of 900—950 kv. energy. The relative efficiencies of the γ-rays from Li and B are compared. Except in the case of ^{108}Ag there is little difference in the efficiencies. A. J. M.

Zero effect of counter tubes. H. OSTERWISCH (Physikal. Z., 1938, **39**, 661—665).—The residual radiation of counter-tubes of various dimensions was determined in a rock-salt mine at 1000 m. H_2O equiv. The val. was const. over the normal working range of the tubes. A. J. M.

Cause of abrupt changes in counter-tube discharges. R. SCHADE (Naturwiss., 1938, **26**, 546—547).—The sudden changes in counter-tube discharges are attributed to statistical variations in the subsequent emission of electrons, possibly a photo-electric emission from the cathode. A. J. M.

Heavy electrons in cosmic rays. V. VEKSLER and N. DOBROTIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 479—482; cf. A., 1938, I, 114, 382, *et al.*).—The previous arrangement of proportional counters is now used at sea level to determine the dependence of the no. of coincidences on the thickness of an interposed Fe plate. Other causes being eliminated, the particles responsible are shown from range and ionisation to be heavy electrons of mass 50—300m; these are of secondary origin. I. McA.

Large cosmic showers of the atmosphere. P. AUGER and R. MAZE (Compt. rend., 1938, **207**, 228—230).—Data are recorded for coincidences in the recording of counters at 2 m., 5 m., and 20 m. apart, and for the effect of screening. H. J. E.

Hard cosmic-ray showers. W. BOTHE (Indian J. Physics, 1938, **12**, 155—161).—A lecture. W. R. A.

Angles between the components of a pair [of particles produced by γ-rays]. A. ALICHANIAN, B. DZELEPOV, and P. SPIVAK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 379—380).—The no. of particles produced by internal conversion of γ-rays from 20 mc. of Po deposited electrically on a thin foil (30 μ.) of Al–Be alloy (65% Be) were measured by the method of coincidences in two Geiger counters set at 0°, 30°, 60°, 90°, 120°, 150°, and 180° to each other. The angles between the pairs created by γ-rays (Po and Be) in Pb were also investigated. A strong max. in the no. of coincidences occurs at 45—50°. F. J. L.

Ionisation in gases at high pressures by gamma radiation. J. CLAY and M. KWIESER (Physica, 1938, **5**, 725—736).—Measurements are recorded for Kr, A, and N_2 at pressures up to 140 atm. and for fields up to 6000 v. per cm. Addition of small amounts of A has no effect on the results for N_2, and vice versa, but addition of a small amount of O_2 to N_2 or A made it more difficult to obtain saturation in these gases. The effect of screening with $\geqslant 10$ mm. of Pb on the ionisation produced in N_2, A, Kr, and Xe by the γ-rays from Ra was studied. H. J. E.

Theory of natural and artificial radioactivity based on the constitution of atomic nuclei. A. VÉRONNET (Compt. rend., 1938, **207**, 121—123; cf. A., 1938, I, 429).—On the basis of the theory that all at. nuclei are built up from D^+ and $^3H^+$, natural radioactivity arises from the spontaneous decomp. of $^2{}^3H \rightarrow \alpha + \beta + D$. Induced radioactivity is due to interaction between ^3H particles and protons, deuterons, neutrons, and α-particles. Schemes for these interactions are given. W. R. A.

Artificial transformation of a proton into a neutron. M. FIERZ (Helv. Phys. Acta, 1936, **9**, 245—264; Chem. Zentr., 1936, ii, 933).—Theoretical. H. J. E.

Theory of nuclear forces. C. MØLLER (Nature, 1938, **142**, 290—291). L. S. T.

Theory of β-decay. M. H. HEBB (Physica, 1938, **5**, 701—704).—The method of Crane and Halpern for detecting the neutrino is discussed. For the validity of this method it is necessary that the β-disintegration be adiabatic. Theoretical arguments that this is so are advanced. H. J. E.

Interaction between charged particles and radiation field. H. A. KRAMERS (Nuovo Cim., 1938, **15**, 108—114).—Mathematical. O. J. W.

Interaction between elementary particles. E. C. G. STUECKELBERG (Compt. rend., 1938, **207**, 387—389).—Mathematical. A. J. E. W.

Transformations of elements in the interior of stars. II. C. F. VON WEIZSÄCKER (Physikal. Z., 1938, **39**, 633—646).—The assumption that all the known elements are being formed in stars at present

is discarded on the grounds that the lower limit of the occurrence of He in stars based on it does not agree with experiment, the existence of U and Th cannot be satisfactorily explained, and the explanation of Harkins' rule given previously (A., 1937, I, 214) in this connexion is not correct. The sources of energy produced by stars are discussed. Such energy must depend alone on nuclear reactions involving light nuclei. The necessary physical conditions for the production of elements and for the production of all types of nuclei in comparable amounts are considered. A. J. M.

Deviation of the nuclei $^{4}_{2}$He and $^{16}_{8}$O from the Hartree model. B. O. GRÖNBLOM (Z. Physik, 1938, **110**, 37—57).—A mathematical discussion of the correction arising from nuclear structure to be applied to the Hartree energy. The discussion is based on assumptions as to the nuclear forces involved. H. C. G.

Fundamental physical concepts. C. V. DRYSDALE (Nature, 1938, **142**, 288—289).—Theoretical. L. S. T.

Cosmological and atomic constants. D. S. KOTHARI (Nature, 1938, **142**, 354—355). L. S. T.

Gravitational constant, specific charge, and ratio of mass of proton and electron. H. ERTEL (Naturwiss., 1938, **26**, 498—499).—Theoretical. A relationship between the gravitational const. (f), the sp. charge (e), the mass of the electron and proton (m), Sommerfeld's fine structure const. ($\alpha = 1/137$), and the no. of protons (N = no. of electrons for electrical neutrality of all matter in the universe) is derived, which gives a satisfactory val. for f when experimental vals. are substituted. A. J. M.

Quantum mechanical-relativistic foundation of the connexion between the universal physical constants. H. ERTEL (Naturwiss., 1938, **26**, 499—500).—The relationship between the universal physical consts. h, c, $\pm e$ (electrical quantum), $\pm m$ (mass of proton and electron), f (Newton's gravitational const.), and λ (cosmological const. of the relativistic field equations) has been derived by means of a modification of the theory of a static universe put forward by Sambursky *et al.* (Phys. Rev., 1938, **53**, 256). A. J. M.

Order of magnitude of probabilities of radioactive transition in the nucleus. B. PONTECORVO (Compt. rend., 1938, **207**, 230—232).—Theoretical. H. J. E.

Powers of exchange between elementary particles and Fermi's β-disintegration theory as consequences of a possible field theory of matter. E. C. G. STUECKELBERG (Helv. Phys. Acta, 1936, **9**, 389—404; Chem. Zentr., 1936, ii, 2087).—A theory is considered in which the electron, neutrino, proton, and neutron are regarded as quantum states of a single elementary particle. A. J. E. W.

Characteristic functions of the fundamental operators of the Dirac theory of the electron. G. PETIAU (Compt. rend., 1938, **206**, 1455—1457).—Mathematical. A. J. E. W.

Charge-dependence of nuclear forces. N. KEMMER (Proc. Camb. Phil. Soc., 1938, **34**, 354—364).—The hypothesis that the forces between elementary nuclear particles are independent of the charges of the particular particles involved ("charge-independence hypothesis") is extended to explain the proton–proton interaction. F. J. L.

Binding energies of the hydrogen isotopes. A. H. WILSON (Proc. Camb. Phil. Soc., 1938, **34**, 365—374).—Assuming that the potential energy of a proton and a neutron is of the form $e^{-\lambda r}/r$, the wave equation of the deuteron in its ground state is solved, and the binding energy of the isotope ^{3}H is calc. F. J. L.

Relativity correction for the ionisation energy of atoms with two electrons. H. A. S. ERIKSSON (Z. Physik, 1938, **109**, 762—773).—The general formula for the relativity correction of the ionisation energy of atoms with 2 electrons and any nuclear charge Z is shown to be an expansion of $1/Z$. The energies of dissociation thus corr. are shown for a no. of atoms to be in better agreement with experimental results than the non-relativistic vals., especially in the cases of He I and Li II. L. G. G.

Energies associated with the two-centre problem. I. General features of the energy surface. (MISS) E. MONROE (Proc. Camb. Phil. Soc., 1938, **34**, 375—381).—Mathematical treatment of the quantal problem of one electron in the field of two unequal nuclei. F. J. L.

Emission spectra of ozone in the ultra-violet. J. JANIN (Compt. rend., 1938, **207**, 145—146).—The emission spectrum of O_3, containing a trace of N_2, has been photographed from 3050 to 4530 A. by an apparatus which is described. A continuous spectrum is obtained containing numerous emission bands the λλ and relative intensities of which are given. Some of the observed bands approx. coincide with the principal max. of O_3. W. R. A.

Gas temperature and population of atomic levels in a carbon arc at low pressure. R. C. MASON (Physica, 1938, **5**, 777—783).—Intensity measurements on the 3883 A. CN band and on certain lines of Ba and Zn, added to the anode, were measured, and used in calculating the relative population of the excited states. With decreasing pressure the density of excited atoms exceeded that to be expected from the thermal equilibrium by increasing amounts. H. J. E.

So-called boric acid continuum emitted from the auriole of the carbon arc. W. FINKELNBURG and H. HESS (Physikal. Z., 1938, **39**, 666—668).—The so-called H_3BO_3 continuum obtained from a C arc impregnated with H_3BO_3 and burning in O_2 or a gas containing O_2 can be ascribed to a B–O compound, the exact nature of which is unknown. A. J. M.

Spectrum of rubidium hydride, RbH. A. G. GAYDON and R. W. B. PEARSE (Nature, 1938, **142**, 291).—The passage of a discharge through Rb + H_2 gives a band spectrum of the many-line type extending from 4800 to 6500 A. The bands are due to a

$^1\Sigma \rightarrow {}^1\Sigma$ transition. Approx. positions of the heads and approx. vals. of the mol. consts. are recorded. L. S. T.

Band spectra of selenium, tellurium, and their oxides, in the ultra-violet. C. S. PIAW (Ann. Physique, 1938, [xi], **10**, 173—290).—The study of the band spectra of Se, Te, SeO, TeO, SeO_2, and TeO_2 has been extended to the far ultra-violet. Several band systems (including some new systems) have been observed in the far ultra-violet for Te and Se, two systems for SeO and one for TeO in the ordinary ultra-violet, and a spectrum, rich in bands, for SeO_2 and TeO_2 in the ultra-violet and visible. The new band systems, due to diat. Se_2 and Te_2, violate the Mecke–Birge rule, as also do those due to S_2 (cf. Wieland *et al.*, A., 1934, 1047). The new absorption bands of SeO_2 and TeO_2 have been studied qualitatively and quantitatively, and their vibrational structure has been partly analysed. SeO bands show resolution which does not exist in the spectra of O_2, SO, and TeO, and this is attributed to two systems of different bands. The rotational structure of several bands of SeO and TeO has been partly analysed and the energies of dissociation of the excited and normal states of TeO have been determined. Comparison of the mol. consts. of the spectra of these elements with those of their oxides shows a regular variation of the spectroscopic properties for the mols. of the same group. The identity of the chemical bond in the oxides of the S group has been deduced from the recorded spectroscopic data. W. R. A.

Sharp mitogenetic spectra. G. DECKER (Protoplasma, 1936, **25**, 515—527; Chem. Zentr., 1936, ii, 1003).—Resolution to 5 A. was achieved with radiation from a yeast culture. H. J. E.

Absorption spectrum of diacetyl between 1500 and 2000 A. V. R. ELLS (J. Amer. Chem. Soc., 1938, **60**, 1864—1866).—Absorption regions in the vapour correspond generally with those of $COMe_2$ and COMeEt, although displaced in the direction of longer λ. The existence of other bands permits Ac_2 to be identified in presence of $COMe_2$ and COMeEt. E. S. H.

Ultra-violet spectrometry of *d*-araboascorbic and glucoheptoascorbic acid.—See A., 1938, II, 347.

Group resonators. XXIV. Predominance of musical intervals in simple spectral series and in the spectra of group resonators. D. RĂDULESCU. XXV. Intra-atomic group resonators and the ratios of frequencies of the absorption and luminescent bands of the rare earths. Absorption spectrum of NO_2. D. RĂDULESCU and A. CIOARĂ (Bul. Soc. Chim. România, 1937, **19**, 3—20, 21—34).—XXIV. νν of the spectral lines of the series for monat. elements, and the limits of the series, represent a succession of harmonics with musical intervals of the natural scale predominating. The narrow bands of the vapour spectrum, the groups of lines forming a band, and the νν of the max. of the normal spectrum in solution are separated by the same musical intervals. The analogy between group oscillators and simple acoustic oscillators is developed. Several predictions are substantiated by reference to the spectra of $C_{10}H_8$, $C_{10}H_7Me$, NH_2Ph, NHPhAc, PhBr, $C_6H_4Br_2$, and fluorene in C_6H_{14}.

XXV. Elements with configurations sufficiently remote from that of a rare gas form group resonators, the valency electrons constituting a mobile system of coupled electrons. The cathodic luminescence spectrum of Pr and the absorption spectra of Nd and Pr do not present musical intervals as predicted. The prediction of musical intervals in the absorption spectrum of NO_2 is in accord with experimental data. W. R. A.

Absorption spectrum and molecular structure. II. Phenol and its derivatives. III. Derivatives of organic acids. S. KATO and F. SOMENO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 905—911, 912—921; cf. A., 1937, I, 597).—II. The absorption spectra of PhOH, PhOMe, and Ph_2O have been examined in the gaseous state and in solution in Et_2O or conc. H_2SO_4. Each spectrum is divisible into two band systems, series (*a*) and (*b*), of unequal intensity. This type of absorption, similar to that of H_2O and lower aliphatic alcohols, appears to be associated with the presence of a singly-linked tervalent O atom. The series (*b*) of gaseous PhOH and PhOMe and in Et_2O solution, which is the strong band on the shorter-λ side, is attributed to a transition to ^1A, whilst the weak bands, series (*a*), are attributed to the transition between $2p(x)$ and $(3s)^3A$. With Ph_2O the intensities of the two absorptions are reversed, due probably to the influence of the strong field from the two Ph radicals on the O atom. The appearance of series (*a*) and (*b*) in the absorption of the compounds in H_2SO_4 solution indicates that the pairing of $2p(x)$ electrons of the O atom is not destroyed by the effect of strong interaction with H_2SO_4, thus differing from the aromatic amines (*loc. cit.*). The continuum, however, is displaced towards longer λλ, and the intensities for H_2SO_4 solutions are considerably stronger than those for the gas or Et_2O solution, due to the effect of the strong mol. field of H_2SO_4 close to the O.

II. The absorption band near 3000 A., found in all ketones and aldehydes, and characteristic of the C:O group, is not found for acids and several acetates. Comparison of the absorption bands due to the Ph radical for the compounds between PhOMe and PhOAc, and between COPhMe and MeOBz, and examination of the spectra in the far ultra-violet due to the C:O group and the O atom of these compounds, lead to the conclusion that the normal and excited orbits of the non-bending electron of the singly-linked O in the mol. are close to the C:O group, in which strong polarity causes the attractive interaction. Thus the reduction of the net charge confined in the O of the C:O group cannot give rise to the transition of the forbidden type, $2p(y) \rightarrow (a\text{–}a)$, which corresponds with the absorption near 3000 A. W. R. A.

Absorption spectra by reflexion of organic substances in the solid state. (MME.) T. GUILMART (Compt. rend., 1938, **207**, 289—291).—The technique of the method is outlined. The absorption spectra in the range 2470—2700 A. of the solid amides $Ph\cdot[CH_2]_n\cdot CO\cdot NH_2$ ($n = 0$—6) have been studied. The narrow bands due to the Ph chromophore group

increase in intensity for $n = 0$—4, but decrease, with some displacement towards higher $\lambda\lambda$, for $n = 5$ and 6. The intensity of the continuous absorption decreases up to $n = 4$, increasing for $n = 5$—6. These results confirm that buckling of the mol. occurs with $n > 4$.

A. J. E. W.

Absorption spectra of organic substances in concentrated sulphuric acid. III. Substances with ethylenic linkings and carbonyl groups. F. BANDOW (Biochem. Z., 1938, **298**, 81—100; cf. A., 1938, I, 227).—Lower aliphatic, unsaturated mono- and di-carboxylic acids in H_2SO_4 absorb light of short λ only, the curve for crotonic acid exhibiting a max. at 2300 A., whilst the higher members of the series (*e.g.*, oleic acid) exhibit max. at 3050 A. (3700 when diluted). Allyl alcohol and bromide, vinyl Et and vinyl Bu ether, simple unsaturated hydrocarbons and their Cl substitution products (*e.g.*, chlorobutadiene), and aromatic compounds containing ethylenic linkings also have max. absorption in the region 2400—4400 A. Results are somewhat different with H_3PO_4 as solvent. W. McC.

Absorption and fluorescence of porphyrins.—See A., 1938, II, 381.

Phthalocyanines and associated compounds. XIII. Absorption spectra. J. S. ANDERSON, E. F. BRADBROOK, A. H. COOK, and R. P. LINSTEAD (J.C.S., 1938, 1151—1156).—The absorption spectra of phthalocyanine (I), 15 of its metallic derivatives, and a no. of associated compounds containing the tetrazaporphin (porphyrazine) ring have been examined in the visible region. The spectrum of (I) is composed of $\leq$ seven bands which can be placed in two groups, in each of which the intensity diminishes regularly with increasing ν. Within each group the bands are separated by a const. ν difference. Introduction of metals into (I) causes a shift in the spectrum to higher $\nu\nu$, the displacement increasing with the at. no. of the central atom. The various spectra are compared and are correlated with the spectra of the porphyrins and azaporphyrins. W. R. A.

Absorption spectra of co-ordination compounds. III. Special bands of chromium complexes. R. TSUCHIDA and M. KOBAYASHI (Bull. Chem. Soc. Japan, 1938, **13**, 471—480).—The bands for aq. solutions of $[Cr(H_2O)_6]Cl_3$, $[Cr(NH_3)_6]Cl_3$, $[Cr(NH_3)_5Cl]Cl_2$, $[Cr(NH_3)_5NCS](NCS)_2$ (also prepared with $1H_2O$), $[Cr(NH_3)_2(NCS)_4]NH_4,H_2O$, $[Cr(NCS)_6]K_3,4H_2O$, and $[Co(NH_3)_5CrO_4]Cl$ are recorded. All these complexes contain first and second bands due to co-ordinated Cr‴, the NCS group gives rise, when present, to a special band and when anions are present there is a third band attributed to *trans* pairing. The spectrochemical series of Cr is identical with that of Co complexes. K_2CrO_4 has the second and third bands. The bands of the polynuclear compound are analysed into those of the component complex radicals. F. R. G.

Absorption spectra of *cis*- and *trans*-isomerides in the near infra-red. Y. TA (Compt. rend., 1938, **207**, 326—329).—The absorption spectra of *cis*- and *trans*-CHCl:CHCl and -CHI:CHI (I) in the ν range 6000—9320 cm.$^{-1}$ have been studied. The existence of combination $\nu\nu$ giving replicas of the vibrational spectrum in the neighbourhood of the principal CH lines (cf. A., 1938, I, 434) is confirmed, and these spectra enable the *cis*- and *trans*-isomerides to be distinguished. New vibrational $\nu\nu$ for (I) have been approx. determined. A combination ν due to CH and the C:C vibration at 1580 cm.$^{-1}$ is observed with both isomerides, although this vibration should be inactive with the *trans*-form. Harmonics of the fundamental CH ν in CHX:CHX appear to have two components.

A. J. E. W.

Kinetics of the OH radicals as determined by their absorption spectrum. III. Quantitative test for free OH; probabilities of transition. O. OLDENBURG and F. F. RIEKE (J. Chem. Physics, 1938, **6**, 439—447).—The abs. intensities of OH absorption lines in H_2O vapour thermally dissociated at 1473° have been investigated by photographic photometry and the transition probabilities (f vals.) computed. Comparison of these with known f vals. of other mols. indicates that the OH band belongs to a half-forbidden transition. The calc. lifetime of the excited state is approx. 4×10^{-6} sec.

W. R. A.

Infra-red absorption of solutions of hydroxides and hydrolysing salts. W. GORDY (J. Elisha Mitchell Sci. Soc., 1935, **51**, 242—243).—Hydroxide mols. in solution have characteristic bands at 1·81, 2·60, 3·65, and 5·2 μ. The OH ion has a characteristic band at 2·30 μ. and hydrated acid mols. have a band at 5·6 μ. The bands at 2·30, 3·65, and 5·2 μ. are fundamentals, the others being harmonics. CH. ABS. (*e*)

Intra- and inter-molecular "hydrogen bond" and absorption spectra in the near infra-red. R. FREYMANN (J. Chem. Physics, 1938, **6**, 497—498).—Attention is directed to publications by the author, since 1932, in this field. The main results are summarised. W. R. A.

Vapour–liquid–solution displacements in vibration absorption bands. J. W. ELLIS and E. L. KINSEY (J. Chem. Physics, 1938, **6**, 497).—The displacements from the vapour positions of certain sharp infra-red CH and OH bands of pure liquids and of solutions in CCl_4 and CS_2 are considered. CH bands are influenced by the surrounding medium < OH bands. The extent of the shift depends on the magnitude of the frequency. Shifts in non-polar solvents are > those in pure liquids. CS_2 solutions give shifts > those in CCl_4 solutions. W. R. A

Absorption of infra-red radiation by thin layers of air. G. FALCKENBERG (Meteorol. Z., 1936, **53**, 172—175; Chem. Zentr., 1936, ii, 2118).—The variation of the absorption of air layers 110—1020 cm. thick with the H_2O v.p. and the temp. of the source has been investigated. A. J. E. W.

Infra-red absorption and Raman spectra of liquefied hydrogen chloride. B. VODAR, R. FREYMANN, and Y. TA (J. Phys. Radium, 1938, [vii], **9**, 282—286).—The infra-red absorption spectrum of gaseous and liquid HCl has been examined from 0·8 to 2·1 μ.; the third harmonic, anticipated to lie between 0·9 and 1·1 μ., could not be detected, nor could any Raman displacement, corresponding with its funda-

mental, be observed in the spectrum of liquid HCl at −80°. In the second harmonic a new band at 1·29 μ. appears in addition to the band at 1·23 μ.; the former disappears gradually as the temp. increases and characterises associated HCl mols., whilst the latter is due to single mols. The extent of association is small. The difference in location of band max. in gaseous and liquid HCl is discussed. W. R. A.

Absorption of carbon dioxide in the region of the band λ = 4·3 μ. between 300° and 1000° K., and the radiation of furnace gases and its practical calculation. O. BRONDER (Physikal. Z., 1938, **39**, 620—621).—Remarks on papers by Tingwaldt (A., 1938, I, 117) and Schack (Z. tech. Physik, 1924, **5**, 267). The latter, in deriving the formula for the total emission of a band, overlooked the variation with temp. of the indices in Beer's law. When this temp. effect is taken into account the results of Tingwaldt agree with the formula. A. J. M

Absorption spectrum of pyrrole, thiophen, and furan in the middle infra-red. R. MANZONI-ANSIDEI and M. ROLLA (Atti R. Accad. Lincei, 1938, [vi], **27**, 410—413).—Measurements in the range 600—1500 cm.$^{-1}$ are recorded. O. J. W.

Comparison of the infra-red absorption spectra of heterocyclic compounds and homocyclic hydrocarbons. J. LECOMTE (Compt. rend., 1938, **207**, 395—398).—Absorption max. and Raman νν (500—1350 cm.$^{-1}$) for C_6H_6, PhMe, *cyclo*hexane, $C_{10}H_8$, and related heterocyclic compounds are compared and discussed with reference to the symmetry of the mols. A. J. E. W.

Infra-red absorption spectrum of hydrogen peroxide. C. R. BAILEY and R. R. GORDON (Trans. Faraday Soc., 1938, **34**, 1133—1138).—Measurements with liquid and gaseous H_2O_2 are reported. The results coupled with Raman data support the structure proposed by Penney and Sutherland (A., 1934, 1158). E. S. H.

Assignment of the fundamental frequencies and computation of the potential function of tetrachloroethylene. J. DUCHESNE (Nature, 1938, **142**, 256).—A re-investigation of the spectrum of C_2Cl_4 using a potential function of the type employed by Manneback and Verleysen (A., 1937, I, 223) gives for the C–C force const. a val. of 8×10^5 instead of $6{\cdot}25 \times 10^5$ dynes per cm. (cf. *ibid.*, 224). Earlier conclusions regarding the existence of resonance in this mol. may be premature, since the frequencies can now be correlated with a force field in which the C–C const. has its normal double-bond val. L. S. T.

Inner rotation and normal vibrations of ethane. III. Statistic calculation of the heat of rotation and entropy of ethane. K. SCHÄFER. IV. Raman spectrum of liquid ethane. J. GOUBEAU and J. KARWEIL. **V. Co-ordination of infra-red and Raman lines with normal vibrations.** J. KARWEIL and K. SCHÄFER (Z. physikal. Chem., 1938, **B**, **40**, 357—375, 376—381, 382—390).—III. Mathematical. The mol. is regarded as spinning symmetrically but with hindered rotation. Application of the theoretical conclusions to recorded data indicates that the hindered rotation is equiv. to 3 kg.-cal. per mol.

IV. Two new lines at 786 and 1491 cm.$^{-1}$ have been observed.

V. From the Raman and infra-red data (cf. A., 1938, I, 295) the 12 fundamental frequencies are assigned. C. R. H.

Diffuse fluorescence spectrum of rare earth ions in solution and in crystals. P. C. MUKERJI (Z. Physik, 1938, **109**, 573—585).—La, Ce, Pr, and Nd ions in solution give rise to fluorescence bands in the near ultra-violet when excited by shorter-wave radiation. La ions in the crystal do not give a fluorescence band, but Ce ions in the crystal give rise to bands the no. of which varies with the anion. The extent of continuous absorption of dissolved La ions is also studied. L. G. G.

Fluorescence in a layer of thickness comparable with the wave-length. II. Fluorescence polarisation. F. S. BARISHANSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 465—468; cf. A., 1938, I, 62).—Fluorescence polarisation of films of fluorescein (10^{-1}—10^{-2} g. per c.c. in H_2O or glycerol) has been studied in relation to orientation of the incident polarised light, film thickness, and concn. The technique permits high concn. and avoids absorption corrections. Results of Vavilov (*ibid.*) are confirmed. I. McA.

Fluorescence of dyes. S. B. SEN-GUPTA (J. Indian Chem. Soc., 1938, **15**, 263—300).—Absorption spectra and fluorescence intensities for carefully cryst. fluorescein, eosin (I), rhodamine 6G (II), rhodulin-orange, Magdala-red (III), rhodamine B (IV), acriflavine (V), benzoflavine, phloxine, and phosphine 2G in EtOH are recorded. The fluorescence yields, opposite to, normal to, and in the line of the incident light, and also the mol. extinction coeff. at 365 mμ., are recorded. The yields are shown to be independent of cell thickness, but except at low concn. the yields fall very rapidly with increase in concn., whilst the max. of the fluorescence bands are shifted towards the red. The yields ∝ λ of the exciting light. Mol. conductivities at 29—30° for (I)—(V) are recorded. Quenching of fluorescence is considered to be due to formation of micelles which break up on dilution (cf. Moilliet *et al.*, A., 1935, 299) as there is a break in the conductivity/√concn. curve corresponding with the concn. at which rapid quenching of the fluorescence begins. F. R. G.

Photochemical studies. XXVI. Fluorescence of acetone vapour and its relation to the photochemical decomposition. M. S. MATHESON and W. A. NOYES, jun. (J. Amer. Chem. Soc., 1938, **60**, 1857—1864).—The ratio of intensities of absorbed to fluorescent light is a function of incident light intensity and of time of exposure. The Stern–Volmer equation is obeyed only at very low intensities. The fluorescence spectra of $COMe_2$ and Ac_2 are identical at λλ >5000 A. The fluorescence of $COMe_2$ is increased greatly by small amounts of Ac_2. The mechanism is discussed and an explanation advanced, based on the deactivation of excited $COMe_2$ mols. by Ac_2, the excited Ac_2 being responsible for the fluorescence.

An apparatus for study of fluorescence of gases is described. E. S. H.

Fluorescent ion of chromium in ruby. B. V. THOSAR (Phil. Mag., 1938, [vii], **26**, 380—389).—The Zeeman pattern of the red fluorescence doublet of ruby at −180° is explained by the hypothesis that the spin-moment of the 3*d* electrons of the $Cr^{\cdots}$ ion responds only to the external magnetic field, the orbital moment of the ion being unaffected. This entails that the fluorescent $Cr^{\cdots}$ ion substitutes for $Al^{\cdots}$ ions in the Al_2O_3 lattice. The hypothesis is in agreement with the theory of paramagnetism of the ions of the transition series. The calc. Zeeman interval is of the same order of magnitude as the observed, but numerically different. A possible explanation of this difference and also of the asymmetry of the Zeeman pattern is offered. The difference in intensity of the red doublet for ruby and sapphire, and in their colour, is discussed, and the intensity of this forbidden doublet is explained. W. R. A.

Distribution of fluorescence excitation of bivalent europium in calcium fluoride and of bivalent samarium in calcium sulphate. H. P. ECKSTEIN (Nature, 1938, **142**, 256—257).—Max. of excitation λλ for the blue and red fluorescences, respectively, are recorded. L. S. T.

Chemiluminescence of the chlorophylls and other porphyrin metal complex salts. P. ROTHEMUND (J. Amer. Chem. Soc., 1938, **60**, 2005).—Red chemiluminescence is exhibited when solutions of chlorophyll in tetrahydronaphthalene (I) are heated at 125—190°. Mg and Zn complex salts of porphin and of αβγδ-tetraphenylporphin show the same phenomenon in (I), xylene, *p*-cymene, and bromo-*cyclo*hexane. E. S. H.

Non-adiabatic reactions. Chemiluminescence. M. G. EVANS, H. EYRING, and J. F. KINCAID (J. Chem. Physics, 1938, **6**, 349—358).—Theoretical. Chemiluminescent reactions are non-adiabatic because emission of radiation can occur only by transition from a higher to a lower potential energy surface. The second law of thermodynamics places an upper limit on the efficiency of excitation by radiationless transitions and on the no. of quanta of energy emitted. Upper potential energies are reached by activation by black-body radiation at the temp. of the surface or by "crossing" of potential energy surfaces. The experimental data of Audubert (A., 1937, I, 164) on chemiluminescent reactions occurring during the thermal decomp. of metallic azides are interpreted in the light of the theory. W. R. A.

Cathode[-ray] luminescence of aluminium oxide. E. IWASE (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 761—774; cf. A., 1932, 1076; 1933, 446).—Japanese rubies give a cathode-ray luminescence identical with, although weaker than, that of N. Carolina rubies. Synthetic Al_2O_3 when calcined at 1000—1200° with small additions of Sm salts gave an orange luminescence; Mn produced an orange-green colour, whilst Cr gave a red luminescence under all conditions. R. C. M.

Photochemical investigations of metal sulphides. I. Crystal structure and luminescence of sulphide phosphors. S. MAKISHIMA (J. Soc. Chem. Ind., Japan, 1938, **41**, 202—205 B).—ZnS and CaS phosphors are cryst. The effect of temp. and the influence of crystal structure (*e.g.*, Zn blende or wurtzite types of ZnS) on the luminescence are discussed. W. R. A.

Properties of zinc sulphide phosphors. F. SEITZ (J. Chem. Physics, 1938, **6**, 454—461).—The properties of pure and Cu-activated ZnS phosphors are interpreted by a method similar to that used for alkali halide phosphors activated by Tl (A., 1938, I, 230). Ordinary luminescent varieties of ZnS are assumed to have the high-temp. hexagonal (wurtzite) structure. The combination of photoconductivity and the bimol. decay law of phosphorescence implies that excitation of ZnS phosphors is accompanied by an ionisation process, phosphorescence being the result of the recombination of ionised centres and electrons. Application of the quantum theory of solids shows that the ionisation process does not involve the $Zn^{\cdot\cdot}$ and S'' ions of the lattice. The pure ZnS phosphor probably contains neutral interstitial Zn atoms and these may be responsible for luminescence and photoconductivity, whilst in the Cu-activated phosphor interstitial Cu atoms are responsible. A study of the relative stability of interstitial and substitutional Cu ions according to the Schottky–Wagner theory of deviations from stoicheiometrical proportions indicates that the interstitial Cu atoms are probably in a metastable condition. W. R. A.

Luminescence efficiency of zinc silicate phosphors in the gas discharge. A. RÜTTENAUER (Z. tech. Physik, 1938, **19**, 148—150).—The efficiency of Zn silicate phosphors activated with Mn for the detection of ultra-violet radiation has been investigated. The luminescence radiation shows three different max. according to the [Mn] with exciting radiation of different λ. Phosphors containing 0·4% Mn give a max. emission for excitation of λ 736—744 A., those containing 1·5% Mn for excitation of λ 1850—2537 A., and those containing 5% Mn for excitation of λ 3650 A. The higher is the [Mn] the longer is the λ of the exciting light for max. emission. With a phosphor containing 1·5% Mn radiation of λ 2537 A. (Hg discharge) was converted into emission of λ 5350 A. with a quantum efficiency of 0·8. A. J. M.

Charging potential of phosphorescent masses on irradiation with electrons. H. BEY (Physikal. Z., 1938, **39**, 605—611).—An insulated phosphorescent screen behaves like an insulated metal screen on irradiation with electrons. With increasing anode potential it becomes positively charged. From a certain point it follows the anode potential, but much more slowly, differing in this respect from a metal screen. The relationship between the intensity of the emitted light and the anode potential was investigated. A. J. M.

Raman spectra of ammonia and the ammonium ion. G. COSTEANU (Compt. rend., 1938, **207**, 285—286).—Weak Raman lines 3460 and 3545 cm.$^{-1}$,

corresponding with lines in the absorption spectrum (A., 1935, 563), have been observed with the three principal NH_3 frequencies in liquid NH_3 at −40°. These lines also occur, at higher νν, in conc. aq. NH_3 and in solutions of NH_4CNS and NH_4NO_3 in NH_3. These solutions and aq. NH_4NO_3 also give Raman νν at ~ 1387, 1456 (due to $NH_4^{\cdot}$ or NO_3'), 1655, and 1687 cm.$^{-1}$ (due to $NH_4^{\cdot}$). A. J. E. W.

Raman spectra of hydrogen and deuterium sulphides in the gas, liquid, and solid states. G. M. MURPHY and J. E. VANCE (J. Chem. Physics, 1938, **6**, 426—429).—In gaseous and liquid H_2S and D_2S only one Raman displacement was observed; in the solid state both compounds give one single line and a close doublet. The differences $\nu_{gas} - \nu_{liq.}$ is 1·4% and $\nu_{liq.} - \nu_{solid}$ is 1·3%. Available spectroscopic data do not permit calculation of isotope effect, force consts., anharmonicity, or angle; the angle is not 90°. W. R. A.

Raman spectrum of gaseous boron trifluoride. D. M. YOST, D. DE VAULT, T. F. ANDERSON, and E. N. LASSETTRE (J. Chem. Physics, 1938, **6**, 424—425; cf. A., 1937, I, 10).—BF_3 was prepared by thermal decomp. of benzenediazonium fluoborate, $PhN_2 \cdot BF_4$. The Raman spectrum excited by the 2537 A. Hg line is recorded. From it and infra-red data, frequencies have been assigned to fundamental modes of vibration in complete agreement with the assignment of Bailey *et al.* (*ibid.*, 548). W. R. A.

Raman spectra of the ClO', ClO_2', and BO_3''' ions. T. G. KUJUMZELIS (Physikal. Z., 1938, **39**, 665—666).—The Raman spectrum of a saturated solution of NaOCl gives, in addition to the H_2O bands, a sharp line at 713±3 cm.$^{-1}$, corresponding with the simple vibration Cl⟷O, and agreeing with the Cl⟷Me line in the Raman spectrum of MeCl. A solution of ClO_2 gives only one sharp line at 935±8 cm.$^{-1}$ which is due to the ClO_2 mol. ClO_2' gives a line at 802 cm.$^{-1}$ H_3BO_3 (5% solution) gives a strong continuum with a line of moderate strength at 878 cm.$^{-1}$ and traces of lines at 400—500 and 1400 cm.$^{-1}$ A. J. M.

Vibrations and structure of the XO_3 ions. T. G. KUJUMZELIS (Z. Physik, 1938, **109**, 586—597).—Several new Raman lines were observed with conc. solutions of carbonates, nitrates, chlorates, bromates, and iodates. From a consideration of the vibrations theoretically possible combined with the available data, it is concluded that the CO_3 ion has a plane configuration, the NO_3 ion has an easily deformable plane structure, whilst the ClO_3, BrO_3, and IO_3 ions are pyramidal. H. C. G.

Raman spectra of crystalline powders. Hydrates. E. CANALS and P. PEYROT (Compt. rend., 1938, **207**, 224—226).—Vals. are given for the bands due to H_2O observed in $H_2C_2O_4,2H_2O$, $CaSO_4,2H_2O$, $BaCl_2,2H_2O$, $Cd(NO_3)_2,4H_2O$, $Na_2S_2O_3,5H_2O$, $SrCl_2,6H_2O$, $MgCl_2,6H_2O$, $MgSO_4,7H_2O$, $ZnSO_4,7H_2O$, $Na_2SO_4,10H_2O$, $K_2SO_4,Al_2(SO_4)_3,24H_2O$, and ice. Even in similarly constituted mols. with the same H_2O of crystallisation (*e.g.*, for $ZnSO_4,7H_2O$ and $MgSO_4,7H_2O$), the bands are quite distinct in structure. H. J. E.

Raman spectra of hydrocarbons containing tertiary C–D linkings.—See A., 1938, II, 401.

Raman effect in tetradeutero-αβ-dibromomethane. S. MIZUSHIMA, Y. MORINO, and S. SUGIURA (Proc. Imp. Acad. Tokyo, 1938, **14**, 250—251).—$CD_2Br \cdot CD_2Br$ was prepared by the following reactions: (i) $CaC_2 + 2D_2O = C_2D_2 + Ca(OD)_2$; (ii) $4D_2O + 5Br + P = D_3PO_4 + 5DBr$; (iii) $C_2D_2 + 2DBr = (CD_2Br)_2$. $(CH_2Br)_2$ was prepared by a similar method. The Raman spectra have been measured and are compared. The calc. Teller–Redlich product ratio for vibrations of the same symmetry class for two isotopic analogues agrees with the experimental val. The results support previous conclusions (cf. A., 1938, I, 233) regarding the mol. structure of $(CH_2Br)_2$. W. R. A.

Raman effect in the diagnosis of the constituents of a mixture of isomeric dihalogenated benzene derivatives.—See A., 1938, II, 401.

Molecular association of acetic acid. P. KOTESWARAM (Z. Physik, 1938, **110**, 118—133).—Raman lines for pure AcOH and its solutions in H_2O, CCl_4, and C_6H_6 are photographed. Increase in temp. of the pure acid, or its dilution with H_2O, shifts the lines to higher frequencies, indicating depolymerisation. CCl_4 and C_6H_6 as solvents do not reduce the association. There is no direct evidence for the existence of hydrates. L. G. G.

Structure of associated molecules of organic acids on the basis of Raman spectra. V. TSCHELINCEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 489—491; cf. A., 1937, I, 502).—On a review mainly of Raman spectra evidence, the form $CR\lessdot^{O(\cdot\cdot H)\cdots O}_{O\cdots(H\cdot\cdot)O}\gtrdot CR$, based on the author's work on keto–phenolic systems, is preferred for dimerides formed by $-CO_2H$ association. A like occurrence of quadrivalent ketonic O is suggested in salicylaldehyde and the enol form of diketones (where Raman −OH νν are absent), and accounts for acid salts of monobasic acids. I. McA.

Molecular diffusion of light by liquids. Variation of diffused intensity with wave-length. A. ROUSSET and R. GARNIER (Compt. rend., 1938, **207**, 142—145).—Comparison of the variation of the intensity of the light diffused by C_6H_6 with that of CCl_4, AcOH, and EtOH by the method of photographic photometry shows that, in the spectral range 3650 to 5460 A., C_6H_6 follows the Vessot–King rule. The ratio of existing abs. vals. of the intensity of light diffused by Et_2O and by C_6H_6 agrees with that of the vals. calc. from this rule and also shows that C_6H_6 obeys it. W. R. A.

Sparking potential in benzene vapour. E. BADAREU and L. CONSTANTINESCO (Compt. rend., 1938, **207**, 217—220).—Vals. of the sparking potential were determined with plane Al electrodes at 0·1—1·8 mm. Hg. The relationship between the sparking potential (V) and the product of the pressure and the distance between the electrodes (pd) passed through a min. at $V = 489 \pm 1$ v. and $pd = 0{\cdot}24 \pm 0{\cdot}01$. H. J. E.

Breakdown potential in benzene vapour. E. BADAREU (Compt. rend., 1938, **207**, 279—281).—A theoretical discussion of previous work (preceding abstract). Ionisation of the C_6H_6 mol. requires an electron of min. energy ~120 e.v., a val. ≫ that for other gases. A. J. E. W.

Investigations of photochemical processes in crystals and measurements by electrical means. R. HILSCH and R. W. POHL (Trans. Faraday Soc., 1938, **34**, 883—888).—When crystals of KBr, containing 10^{-6} of KH in solid solution, are allowed to absorb ultra-violet light, "Farbzentren" are developed and the KH is photochemically decomposed. The photochemical process is accompanied by thermal oscillations of the lattice and an experiment to illustrate this is described. At low temp. no decomp. occurs. Preliminary results for KD are discussed; the dependence of its photochemical yield on temp. is different from that for KH. The absorption spectrum of RbH is given and interpreted as due to electron transitions from the anion to the cation. The magnitude of the binding energy of "Farbzentren" in the lattice of alkali salts is discussed and a method of measuring it electrically is outlined. W. R. A.

Photo-electric primary current in alkali halide crystals as a function of temperature and the concentration of colour centres. G. GLASER and W. LEHFELDT (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 91—108; Chem. Zentr., 1936, ii, 754).—Measurements are recorded for NaCl, KCl, and KBr at −250° to 250°. H. J. E.

Mechanism of photosensitisation by solids. C. F. GOODEVE and J. A. KITCHENER (Trans. Faraday Soc., 1938, **34**, 902—908).—The mechanism of photosensitisation by solids, which is closely allied to the inner photosensitisation by liquids, depends on the nature and action of the absorbed quantum or "exciton" which determines the type of chemical change which takes place. The enhancing power of glycerol and glucose on the activity of solid photosensitisers is probably due to a second stage with a chemical mechanism. Different mechanisms for the fluorescence of phosphors are considered, the "exciton" being generally regarded as a free electron. Detailed photochemical study of the bleaching of chlorazol-sky-blue FF on TiO_2 in the dry state (A., 1938, I, 261) shows that TiO_2 acts as a true photosensitiser. The photographic process is considered to involve both direct and sensitised photo-reactions. The degradation of excitons to heat is discussed. W. R. A.

Photo-electric effect in membranes. II. L. BRAUNER and M. BRAUNER (Rev. Fac. Sci. Istanbul, 1938, **3**, 189—254).—The photo-electric effect with parchment-paper sensitised by graphite has been investigated. There is an optimum thickness for the max. effect. The variation of the effect with the intensity of the light shows a similar curve with a max. Of added substances examined KOH gave the greatest and HCl the weakest photo-effect. A method for the sensitisation of parchment-paper membranes with some vegetable pigments (chlorophyll, lycopene, carotene) is described; of these, chlorophyll gave the greatest effect. Experiments were also carried out to determine the photo-electric effect obtainable with living tissues. The leaves of *Helodea densa* show a definite cross-sectional polarity, the upper side being more photo-sensitive than the under side. A. J. M.

New "positive" barrier plane photo-electric effect and the new barrier plane photocell. B. KOLOMIEZ (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 383—384).—The sensitivity of Tl sulphide photo-cells, in which the electrons pass from the metal to the semi-conductor (positive photo-electric effect), is 10 times that of Se cells under the same conditions of illumination. The e.m.f. is 0·3 v., and the spectral sensitivity is the same as that of the "thallofids." F. J. L.

Photo-electric effect in natural single crystals of red copper ore. R. DEAGLIO (Atti R. Accad. Sci. Torino [Cl. Sci. fis.], 1935, **70**, I, 52—61; Chem. Zentr., 1936, ii, 951; cf. A., 1935, 430). H. J. E.

Relation between electrolytic conduction in solids and crystal structure. J. A. A. KETELAAR (Trans. Faraday Soc., 1938, **34**, 874—881).—The mechanism of conduction in good ionic conductors is discussed. Ag_2HgI_4 is considered in detail in connexion with the Bragg–Williams theory of order–disorder transformations, and the relation between the energy difference and the degree of order is derived experimentally. The difference between true averaged structures and multiple twin structures is indicated; only the former show a high ionic conductivity. W. R. A.

Electrical conductivities and dielectric constants of quartz and certain other crystals. N. G. RAHIMI (J. Phys. Radium, 1938, [vii], **9**, 291—296).—The electrical conductivity of quartz is reduced after keeping at 700° for a period of time, more particularly if the crystals have been maintained under strain. This treatment also causes the disappearance of anomalous dielectric properties of quartz and, therefore, appears to produce in quartz a well-defined state. W. R. A.

Dielectric constants of glycerides. B. V. BHIDE and R. D. BHIDE (Current Sci., 1938, **7**, 16).—The dielectric consts. of monomyristin (I) and $COPh_2$ have been determined at radio frequencies. The curve of dielectric const. against temp. shows distinct breaks at the transition temp. of these substances. The m.p. of the different forms of (I) given by Malkin *et al.* (A., 1937, 1, 17) were confirmed, but a sudden break was also found at 27° instead of at 24° as given by the above workers. A. J. M.

Variation of dielectric constant on solidification of homopolar liquids. R. GUILLIEN (Compt. rend., 1938, **207**, 393—395; cf. A., 1938, I, 297).—ϵ for PhMe, *m*-xylene, CCl_4, and liquid N_2 increases on solidification. Data are given for ϵ and the mol. polarisation of N_2 at 63—78° K. A. J. E. W.

Dielectric-constant measurements with pure organic liquids. R. J. W. LE FÈVRE (Trans. Faraday Soc., 1938, **34**, 1127—1132).—Apparatus and technique are described. Results for 21 liquids

over different ranges of temp. are reported. All the liquids appear to have approx. the same dielectric const. at their crit. points. E. S. H.

Dipole moments of anthracene derivatives and the stereochemical mechanism of additive and fission reactions in the anthracene series.—See A., 1938, II, 407.

Dipole moments of vapours. VII. Calculation of valency angles in chloroform and methylene chloride. L. G. GROVES (J.C.S., 1938, 1195—1196; cf. A., 1938, I, 64).—Using vals. for the moments of the C–Cl and C–H links obtained from the recorded moment of MeCl, the Cl–C–Cl intercovalency angle, after allowing for induction components, is found to be approx. tetrahedral in both $CHCl_3$ and CH_2Cl_2, and agrees with electron diffraction data. W. R. A.

Molecular volumes and parachors of mercuric halides and their group relationships. E. B. R. PRIDEAUX and J. R. JARRATT (J.C.S., 1938, 1203—1205).—The mol. vols. of liquid $HgCl_2$ and $HgBr_2$ are > the sums of the at. vols. of their constituents under corresponding conditions. The differences are attributed to differences in covols., which are controlled by internal pressures identified with van der Waals mol. attractions. These pressures are increased in heteropolar mols. containing polar or semipolar bonds. The physical properties dependent on covol. and internal pressure, reviewed for Hg", Cd, and Zn halides, are thus affected by the electronic systems of the mols. The parachors of $HgCl_2$ and $HgBr_2$, determined by the max. bubble pressure method, are < the sums of the parachors of their at. constituents, but a correction for semi-polar bonds brings the vals. into closer agreement. W. R. A.

Refraction of simple organic isomerides. J. M. STEVELS (Rev. trav. chim., 1938, **57**, 921—928).—The theory previously developed (A., 1937, I, 601; 1938, I, 232) is extended to C_2H_6 and C_2H_4 derivatives. F. L. U.

Effect of a longitudinal magnetic field on the conductivity and refractive index of ionised air. B. N. SINGH (Phil. Mag., 1938, [vii], **26**, 244—252).—Measurements of the conductivity and refractive index of ionised air in the presence of applied longitudinal magnetic field have been made, using waves of frequency $8{\cdot}1 \times 10^7$ cycles per sec. Vals. are in agreement with those calc. without approximation from magneto-ionic theory. Vals. do not approach ∞ at the gyro frequency of the incident wave as the magnetic field is increased. O. D. S.

Magnetic rotatory power of imperfect complexes. F. GALLAIS (J. Chim. phys., 1938, **35**, 212—222).—The magnetic rotatory power of the mercuri-iodides and other complexes of Hg, Bi, Cd, and Ag has been investigated. The formation of $[HgI_4]''$ ions is accompanied by a considerable increase in the magnetic rotation, but the investigation of the other complexes shows that the effect is not general, nor is it confined to any particular type of complex. A. J. M.

Periodicity law. Break in continuity in values of molecular rotatory power in optically active homologous series. P. PETRENKO-KRITSCHENKO and J. EKSTER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 493—496; cf. A., 1938, II, 167).—Available data for $[M]_D$ (those of Pickard and Kenyon are not cited) refute rules of its monotonic variation with chain length. Anomalous vals. are really max. or min. as $[M]_D$ in a series is claimed to be of periodic wave form. Similarly, $[M]_D$ increases, then falls, in the succession C·C → C:C → C:C. I. McA.

Rotatory power of quartz in the far ultra-violet and the Schumann region. R. SERVANT (Compt. rend., 1938, **207**, 283—285).—Vals. of the rotatory power (α) at 1950—1525 A. are recorded. Above 1850 A. the results are in agreement with those of Duclaux and Jeantet (A., 1926, 886). α increases rapidly in the Schumann region, and the observed vals. are not in accord with the Lowry–Coode-Adams or Bradshaw–Livens formulæ (A., 1927, 813; 1929, 242). A. J. E. W.

Paramagnetic rotatory power of hydrated neodymium ethyl sulphate in the direction of the optic axis. J. BECQUEREL, W. J. DE HAAS, and J. VAN DEN HANDEL (Physica, 1938, **5**, 753—762; cf A., 1936, 1056).—Measurements at 1·480—4·256°, 14·16—20·42°, and 63·50—77·47° K. are recorded. Vals. of the Verdet const. are calc. Results for the Et sulphate and normal sulphate are compared. H. J. E.

Crystal twins of normal $C_{24}H_{50}$ and the influence of phase transitions on their orientation. G. C. H. KOLVOORT (J. Inst. Petroleum Tech., 1938, **24**, 338—347).—The twin-structure of $C_{24}H_{50}$, m.p. 50·5—50·9°, has been studied. The (110) and (310) planes act as twinning planes. $C_{24}H_{50}$ is biaxial, the birefringence being positive; the angle between the optic axes is about 45° and is less for red light than for blue. At 41° and at 46° new solid phases are formed. J. S. G. T.

Deformation of valency angles. Structure and absorption of derivatives of oximes.—See A., 1938, II, 367.

Structure of the aldol of acetaldehyde.—See A., 1938, II, 392.

Inertness and chemical activity of the rare gases. I. Theory of zero valency. General problem of the chemical activation of the rare gases. II. Stable compounds from the interaction of helium and platinum, activated by cathodic evaporation. III. Comparison of the properties of helium–platinum compounds with those of the hydrogen–platinum system and of compounds of oxygen and nitrogen with the same metal. H. DAMIANOVICH (Bull. Soc. chim., 1938, [v], **5**, 1085—1091, 1092—1106, 1106—1120).—I. A general review of early work on the reactivity of the rare gases.

II. Various methods for preparing He–Pt compounds are described. Two such compounds decompose endothermically at 92·5° and 310°, the calc. heats of reaction being 11,805 and 18,831 g.-cal., respectively.

III. The author's collected researches are sum-

marised and the following conclusions are reached. Only theories of chemical reactions which result in stable compounds can satisfactorily explain the data; the theory of zero valency is unsound as it is based on negative evidence; inertness is a state which can be eliminated under suitable conditions. C. R. H.

Classification of the rare earths. (A) W. KLEMM. (B) W. NODDACK and A. BRUKL (Angew. Chem., 1938, **51**, 575—581).—A discussion in which the former upholds his classification into two groups, whilst the two latter propose three groups. K. W. P.

Primary processes in photodecomposition. M. BURTON and G. K. ROLLEFSON (J. Chem. Physics, 1938, **6**, 416—423).—A simple rupture process is defined as one in which decomp. occurs at the locus of absorption within one vibration period after the creation of the excited state. The term "predissociation" covers all other photodecomp. processes. In diat. mols. the only mechanisms of predissociation possible are by rupture as a result of either spontaneous or induced adiabatic transition from an attractive to a repulsive or "weakly attractive" level. In polyat. mols., spontaneous or induced shifts of energy, or rearrangement of groups, resulting in decomp., may also occur. The various processes are illustrated by reference to S, I_2, O_3, and aldehydes. Two different types of predissociation are indicated for CH_2O, one in a single potential hypersurface and the other a spontaneous transition between two hypersurfaces. W. R. A.

Summation of state for dissociation processes. K. H. RIEWE (Z. Physik., 1938, **109**, 753—757).—Mathematical. The summation of state for a mol. in a partly dissociated gas is calc. on the basis of a method previously employed by Planck in the case of a partly ionised gas consisting of H atoms. H. C. G.

An assumption in the theory of co-operative phenomena. G. S. RUSHBROOKE (Proc. Camb. Phil. Soc., 1938, **34**, 424—428).—The effect of the assumption, "that the term in the partition function for the excited states of a mol. is not affected, owing to intermol. forces, by the environment of the mol.," on the results of the approx. methods of Bragg and Williams used in theoretical work on co-operative phenomena is deduced. F. J. L.

Molecular forces and imperfect gases. W. WEN-PO (Phil. Mag., 1938, [vii], **26**, 225—244).—Theoretical. O. D. S.

Spectroscopy and valency. VI. Periodicity of bonding energies of hydride di-atoms. R. W. BERRIMAN and C. H. D. CLARK (Proc. Leeds Phil. Soc., 1938, **3**, 465—476; cf. A., 1936, 782).—The periodicity of spectroscopic nos. is extended to include bonding energy (heat of dissociation) of hydride di-atoms, and the principle is used to "weight" the vals. recorded by various authors. New vals. of bonding energies calc. by thermal methods are: Si–H 3·27, S–H 3·80, As–H 2·06, Se–H 3·18, Te–H 2·70, and Sb–H 1·6 e.v. Spectroscopic and thermochemical bonding energies are compared and discussed, an anomalous C–H val. is explained, and the C–C val. is examined in relation to the stability of long chains in *n*-paraffins. The departure from additivity increases regularly in the CH—FH series of thermal vals. with increasing polar opposition of the two atoms concerned. N. M. B.

Deformation of molecules and their vibration spectra in the condensed state. E. BAUER and M. MAGAT (Physica, 1938, **5**, 718—724).—It is shown that it is possible to account quantitatively for changes in the Raman and infra-red frequencies associated with groups such as OH and NH, in passing from the vapour to the condensed phase, by a theory of electrostatic interaction. It is unnecessary to postulate more complex phenomena, such as H bond formation. H. J. E.

Calculation of the polarisability of a molecule. M. M. BIEDERMANN (Physica, 1938, **5**, 689—692).—It is shown that the additional polarisation of one atom by the electric dipole induced in another can be described by using the perturbed wave function in the second-order approximation. H. J. E.

Energy levels in real and ideal crystals. N. F. MOTT (Trans. Faraday Soc., 1938, **34**, 822—827).—The conditions under which crystals conduct an electronic current are discussed. The removal of an electron from one ion leaves a "positive hole" which can be filled by an electron from a neighbouring ion, a process which can continue throughout the whole crystal. An electron can be introduced from outside or it can be raised photoelectrically from an inner energy of one ion to "conduction band" levels. Electrons in the conduction band can be trapped in metastable positions. Trapping can occur not only at various lattice imperfections but also in a perfect lattice. W. R. A.

Excited energy levels of insulating crystals. J. C. SLATER (Trans. Faraday Soc., 1938, **34**, 828—832).—A comparison and discussion of existing theories on the excited states of insulating crystals. W. R. A.

Energies of disorder in ionic crystals. W. JOST (Trans. Faraday Soc., 1938, **34**, 860—867).—Theoretical. The magnitude and significance of the energies of disorder for different salts are discussed. These can be $\ll$ lattice energies. Energies from different types of disorder are compared and methods for evaluating the energy barrier, which migrating ions must surmount, are considered. W. R. A.

Mechanism of the movement of ions and electrons in solids and the interpretation of reactions between solids. C. WAGNER (Trans. Faraday Soc., 1938, **34**, 851—859).—In solid ionic compounds, deviations from the strict order of the ideal crystal lattice lead to electrical conductivity by the movement of ions and electrons. Typical examples are discussed and the disorder of the ions is indicated qualitatively. The degree of disorder in AgCl can be calc. from the electrical conductivity of pure AgCl and of solutions containing $CdCl_2$ or $PbCl_2$ in AgCl. The reactions between solids are regarded as caused by the diffusion of ions and electrons through the reaction products formed between the phases of the initial state. In simple cases the rate of chemical change may be calc. from electrical data. This is illustrated by reference

to, *inter alia*, $2Ag + S = \alpha\text{-}Ag_2S$; $2AgI + HgI_2 = Ag_2HgI_4$; $6Li + N_2 = 2Li_3N$; $Cu + AgCl = Ag + CuCl$; $AgCl + NaI = AgI + NaCl$. W. R. A.

Lattice energies of some alkali halides and the electron affinity of iodine. A. N. TANDON (Proc. Nat. Acad. Sci. India, 1937, **7**, 102—110; cf. A., 1934, 719; 1935, 273; 1937, 1, 170, 398).—Previous theory, experimental methods, and results are reviewed. With the thermal ionisation technique used for the bromides, vals. determined for the lattice energies of NaI and KI, and for the electron affinity of I, are 166·4, 150·6, and 72·4 kg.-cal., respectively, confirming available data. I. McA.

Effect of temperature on the atomic distribution in liquid potassium. C. D. THOMAS and N. S. GINGRICH (J. Chem. Physics, 1938, **6**, 411—415).—Using Mo $K\alpha$ radiation, the *X*-ray diffraction patterns of liquid K at 70°, 200°, 295°, and 395° have been obtained. The intensity curves show three peaks becoming less pronounced with rising temp. The at. distributions for 70° and 395° have been determined by Fourier analysis. A rise of temp. causes a shift in the peak positions in the distribution curve to greater distances and the high-temp. curve is more highly damped. W. R. A.

Scattering of *X*-rays by a crystal. J. LAVAL (Compt. rend., 1938, **207**, 169—170).—The scattering of *X*-rays by crystals of calcite and single crystals of sylvine is discussed. W. R. A.

***X*-Ray surface reflexion fields and their application to absorption corrections and to background patterns.** M. J. BUERGER (Z. Krist., 1938, **99**, 189—204; cf. Hendershot, A., 1937, I, 581).—For zero- and *n*-layer photographs, both the normal beam and equi-inclination (*ibid.*, 49) techniques being considered, the nature and position of the areas in Weissenberg *X*-radiograms characterised by surface and transmitted reflexions are calc. for typical crystal habits. Absorption corrections in crystal analysis are simplified by charting of these areas, which may be experimentally realised as a background pattern of use where optical goniometry is unsuitable. I. McA.

Reflecting power of crystals with an ideal mosaic. V. DOLEJŠEK, M. JAHODA, J. JEŽEK, and M. ROZSÍVAL (Nature, 1938, **142**, 253).—Photographic investigation of the relationship between the magnitude of the mosaic structure of crystals and the intensity of *X*-ray reflexion shows that with specially-selected crystals of gypsum, rock-salt (I), and sphalerite (II) the product of the exposure and the magnitude of the ideal mosaic is const. With quartz, where the mosaic is insignificant, the results fluctuate. Under the influence of a direct electric field $\sim 10^4$ v. per cm. the mosaic diminishes for (II) but not (I). L. S. T.

Comparison of the rotary crystal method and the powder method. M. STRAUMANIS and A. IEVIŅŠ (Z. Physik, 1938, **109**, 728—743).—The lattice consts. of rock-salt from 5 sources, determined on single crystals and on the powder, are in good agreement, and are respectively 5·62735±0·000002 and 5·62747±0·000003 A. Measurements on $Co[Hg(CNS)_4]$ show that the lattice consts. vary slightly for individual crystals and lie in the ranges a_{25} 11·08944—11·09756 and c_{25} 4·36465—4·36524 A. L. G. G.

Interpretation of Laue photographs in terms of the reciprocal lattice. C. C. MURDOCK (Z. Krist., 1938, **99**, 205—216).—Crystallo-mathematical. I. McA.

Crystal structure models. W. A. WOOSTER and G. KNOTT (Nature, 1938, **142**, 251).—Models are constructed from table tennis balls and celluloid rod which can be firmly joined together after treatment with $COMe_2$. Mol. packing can be illustrated with balls from which spherical caps have been cut. Photographs of models illustrating the interat. distances and mol. packing of $C_{10}H_8$ are reproduced. L. S. T.

Nature of twinning in potassium and rubidium dithionates. W. H. BARNES and A. V. WENDLING (Amer. Min., 1938, **23**, 391—398). L. S. T.

Structure of rubidium dithionate, $Rb_2S_2O_6$. W. H. BARNES and A. V. WENDLING (Z. Krist., 1938, **99**, 153—180).—Optical activity in untwinned crystals is confirmed. *X*-Ray analysis gives a hexagonal (rhombohedral) cell, *a* 10·02, *c* 6·35 A.; ρ 2·86; 3 mols. per cell; space-group D_3^2; these confirm available data. An extensive analysis based on relative intensities yields parameters almost identical (save for 2 O vals.) with Huggins' vals. (A., 1934, 16) for the isomorphous $K_2S_2O_6$. The S_2O_6'' ion consists of 2 apex-linked SO_3 tetrahedra with trigonal axes collinear with the central S·S bond. S—S, S—O, and O—O are 2·08, 1·50, and 2·51 A., respectively. I. McA.

Rate of crystallisation of aluminium of 99·992% purity. J. CZOCHRALSKI and J. MIKOŁAJCZYK (Wiadom. Inst. Met., 1936, **3**, 106—107; Chem. Zentr., 1936, ii, 3059).—A single crystal of 99·992% pure Al could be drawn from the melt at the crystallisation temp. at a max. speed of 160 mm. per min. The impurities influence the no. of crystallisation centres, but not the rate of crystallisation. H. J. E.

Crystal structure of some bromocupric complexes. A. SILBERSTEIN (Compt. rend., 1938, **206**, 1490—1492).—The compounds $(NH_4)_2[CuBr_4,2A]$ (A = *o*- or *m*-$C_6H_4Me{\cdot}NH_2$) are similar in structure to $(NH_4)_2[CuBr_4,2H_2O]$, having *a* and *b* 7·88, *c* 17·43 and 17·64 A., respectively. Supposed compounds having $A = C_5H_5N$, NH_2Me, or *p*-$C_6H_4Me{\cdot}NH_2$ are of doubtful individuality, as they give *X*-ray powder diagrams identical with those due to mixtures of NH_4Br and $CuBr_2,2A$. A structure proposed for $(NH_4)_2[CuBr_4,2NH_3]$ (A., 1938, I, 91) is corr.; the spatial arrangement of N and Br in NH_4Br is preserved, the Cu atoms occupying two out of 24 possible positions at face centres of the NH_4Br unit cell. A. J. E. W.

Crystal structure of ammonium, potassium, rubidium, and cæsium chloro- and bromopalladates. J. A. A. KETELAAR and J. F. VAN WALSEM (Rec. trav. chim., 1938, **57**, 964—966).—The compounds all belong to the K_2PtCl_6 type. Vals. of *a* (±0·01 A.) for the unit cell and calc. *d* for

the K, NH_4, Rb, and Cs salts, respectively, are as follows: M_2PdCl_6 9·74, 2·83; 9·81, 2·48; 9·99, 3·25; 10·16, 3·68; M_2PdBr_6 9·92, 4·49; 9·95, 4·17; 10·25, 4·68; 10·64, 4·38. F. L. U.

Crystal structure of cæsium aurous auric chloride, $Cs_2AuAuCl_6$, and cæsium argentous auric chloride, $Cs_2AgAuCl_6$. N. Elliott and L. Pauling (J. Amer. Chem. Soc., 1938, **60**, 1846—1851).—$Cs_2AuAuCl_6$, tetragonal, has a body-centred unit, with a_0 7·49±0·02 and c_0 10·87±0·02 A., containing 2 mols.; space-group D_{2h}^{17}—$I4/mmm$. The positions of tho atoms have been determined. $Cs_2AgAuCl_6$ has a similar unit and at. arrangement, with a_0 7·38±0·02 and c_0 11·01±0·02 A. The crystals contain linear $[AgCl_2]'$ and $[AuCl_2]'$ ions and square co-planar $[AuCl_4]'$ ions. A metastable modification of $Cs_2AgAuCl_6$ is described; the unit is cubic, with a_0 5·28±0·01 A., and contains 0·5 mol. E. S. H.

Polymorphism of MnSe. A. Baroni (Z. Krist., 1938, **99**, 336—339; cf. A., 1936, 669).—Three polymorphs (preps. described) are characterised by electron diffraction as similar to the MnS forms (Schnaase, A., 1933, 341). α-MnSe with a 5·44 A. has the cubic NaCl structure. The unstable (→ α) β-MnSe has the cubic Zn blende structure with a 5·82 A. γ-MnSe is hexagonal, like wurtzite, with a 4·12, c 6·72 A. I. McA.

Molecular structure of arsenious oxide, As_4O_6, phosphorus trioxide, P_4O_6, phosphorus pentoxide, P_4O_{10}, and hexamethylenetetramine, $(CH_2)_6N_4$, by electron diffraction. G. C. Hampson and A. J. Stosick (J. Amer. Chem. Soc., 1938, **60**, 1814—1822).—Interat. distances (in A.) and angles recorded are: As_4O_6, As—O 1·80±0·02, ∠OAsO 100±1·5°, ∠AsOAs 126±3°; P_4O_6, P—O 1·65±0·02, ∠OPO 99±1°, ∠POP 127·5±1°; $(CH_2)_6N_4$, C—N 1·47±0·02, ∠CNC 109·5°, ∠NCN 109·5°; P_4O_{10}, P—O 1·62±0·02, P—O′ 1·39±0·02, ∠OPO 101·5±1°, ∠POP 123·5±1°, ∠OPO′ 116·5±1°. The shortening of the distances in As_4O_6, P_4O_6, and P_4O_{10} below the theoretical single-linking vals. is ascribed to single-linking double-linking resonance. The abnormally low val. for P—O′ is ascribed to the polar character of the linking. E. S. H.

Crystal structure of Cu_3As and Cu_3P. B. Steenberg (Arkiv Kemi, Min., Geol., 1938, **12**, A, No. 26, 1—15).—Three phases of formula Cu_3As have been investigated. "Artificial domeykite" is hexagonal with a 7·088, c 7·232 A.; 6 mols. per cell; space-group $C\bar{3}c$. Each As is surrounded by 12 Cu; at. radius of Cu=1·24 A., and of As=1·12 A. Natural domeykite is cubic, a 9·592 A.; 16 mols. per cell; space-group $I\bar{4}3d$; at. radii Cu=1·28, As=1·35 A. The mineral algodonite has been synthesised and studied. Cu_3P is isomorphous with "artificial domeykite," a 7·070, c 7·135 A. T. H. G.

***X*-Ray studies on bismuth trioxide.** L. G. Sillén (Arkiv Kemi, Min., Geol., 1938, **12**, A, No. 18, 1—15).—Four varieties of Bi_2O_3 have been obtained. α-Bi_2O_3 is a pure form stable at room temp. with a monoclinic pseudo-orthorhombic structure as deduced from Laue and powder photographs; a 5·83, b 8·14, c 7·48 A., β 67·07°; 4 mols. per cell; space-group uncertain. β-Bi_2O_3 is also pure but is tetragonal pseudo-cubic; a 10·93, c 5·62 A.; 8 mols. per cell; space-group $C\bar{4}2n$. A complete structure is suggested with 6 O around each Bi, Bi—O=2·37 A. A third phase is cubic but is contaminated with Si; a 5·525 A.; 2 mols. per cell; space-group $Pn3m$. A structure is proposed in which every Bi is surrounded by 6 O at 2·40 A.; it resembles As_2O_3 and Sb_2O_3 somewhat but the formation of mols. is not pronounced. It is isomorphous with Mg_3P_2. The fourth phase contained a slight amount of Al_2O_3 or Fe_2O_3; it is body-centred cubic, a 10·08 A.; 12 mols. per cell; space-group $I23$. Alternative structures are proposed. T. H. G.

Variations in the crystalline parameter of cadmium oxide by insertion of cadmium atoms into its lattice. R. Faivre and A. Michel (Compt. rend., 1938, **207**, 159—161).—Solid solutions of CdO and Cd can be produced by heating a mixture of CdO and Cd in a sealed tube or by heating CdO in vac. In the latter case dissociation is followed by the insertion of free Cd atoms in the CdO lattice. The progress has been studied by *X*-ray crystal analysis. W. R. A.

Structure of the true antimony tetroxide and of the isomorphous stibio-tantalite, $SbTaO_4$. K. Dihlström (Z. anorg. Chem., 1938, **239**, 57—64).—On prolonged ignition at 900° of hydrated Sb_2O_5, the Sb_3O_6OH which is first formed (cf. A., 1938, I, 68) is changed to Sb_2O_4. This also results on prolonged ignition of Sb_2O_3 in air. It is isomorphous with stibio-tantalite, $SbTaO_4$. They are rhombic, a 4·804, b 5·424, c 11·76 A. for Sb_2O_4, and a 4·916, b 5·542, c 11·78 A. for $SbTaO_4$. The unit cell contains 4 mols. and the space-group is C_{2v}^2. At. parameters and a structure diagram are given. F. J. G.

Crystal structure of Ni_3S_2. A. Westgren (Z. anorg. Chem., 1938, **239**, 82—84).—Ni_3S_2 is rhombohedral with a 4·041 A., α 90·3°. The unit cell contains 1 mol. and the space-group is D_3^1. At. parameters and a structure diagram are given. F. J. G.

Structure of libethenite, $Cu_2(OH)(PO_4)$. H. Heritsch (Naturwiss., 1938, **26**, 529).—Similarities between the structure of andalusite and olivenite indicate that the two horizontal axes should be interchanged. Investigation of the structure of libethenite shows that the horizontal axes should be interchanged in this case also. A. J. M.

Crystallographic and optical investigation of some new rare earth tartrates with antimonyl and potassium chloride. C. Minguzzi (Period. Min., 1936, **7**, 77—97; Chem. Zentr., 1936, ii, 776).—Isomorphous crystals of *compounds* of the type $MK(SbO)_2(C_4H_4O_6)_2Cl_2,6{\cdot}5H_2O$ were prepared (M = La, Ce, Pr, or Nd). The crystallographic consts. were: La compound, $a:b:c$ = 0·9642 : 1 : 1·0190, β 93° 09′; Ce compound, $a:b:c$ = 0·9602 : 1 : 1·0095, β 92° 45′; Pr compound, $a:b:c$ = 0·9714 : 1 : 1·0132, β 92° 08′; N dcompound, $a:b:c$ = 0·9694 : 1 : 1·0117, β 92° 44′. H. J. E.

Crystal structure of EuS. W. Nowacki (Z. Krist., 1938, **99**, 339—341).—Powder *X*-radiograms

yield a face-centred cubic cell with a 5·957±0·002 A.; $\rho_{pyk.}$ 5·884; 4 mols. per cell. Photometred intensities indicate a NaCl structure. The ionic radius for Eu", calc. by comparison with the isomorphous SrS and BaS, is ~1·19 A. in accord with Pauling's val. (1·17 A.) from the isomorphous sulphates. I. McA.

Precision determination of the lattice constants of non-cubic substances (Bi, Mg, Sn) by the asymmetric method. A. Ieviņš, M. Straumanis, and K. Karlsons (Z. physikal. Chem., 1938, **B**, **40**, 347—356).—Vals. for the lattice consts. have been obtained with an average accuracy of 0·001%. The vals. agree best with those of Jette and Foote (cf. A., 1936, 45). C. R. H.

Deformation and lattice constants. A. Phillips and R. M. Brick (Metallwirts., 1936, **15**, 541—542; Chem. Zentr., 1936, ii, 754).—Data are recorded for the changes in lattice const. of Au–Ag (76 at.-% Au) and Al–Cu (5% Cu) alloys on extension of a wire specimen. H. J. E.

***X*-Ray diffraction study of soda–boric oxide glass.** J. Biscoe and B. E. Warren (J. Amer. Ceram. Soc., 1938, **21**, 287—293).—Glasses containing the mol. quantities 0·114, 0·225, and 0·333 of Na_2O were examined using Mo $K\alpha$. The changes in interat. distance and in the no. of O atoms surrounding each B atom are continuous and indicate that the B atoms are partly in triangular and partly in tetrahedral co-ordination, the proportion of the latter increasing with Na_2O content. Each Na is surrounded by 6 O at 2·4 A. and each O by 5—6 O at 2·4 A. This arrangement is equiv. to a random network of B atoms bonded to 3—4 O with Na in the spaces. Max. and min. in the property–composition curves (*e.g.*, the marked min. thermal expansion at 16% Na_2O) is explained by the ability of the B atom to change to tetrahedral co-ordination when the Na_2O is present to supply the necessary O. J. A. S.

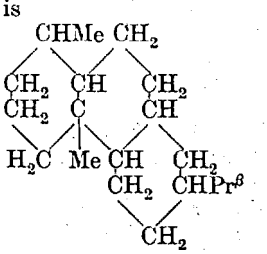
Supra-molecular structure of fibrous materials. O. Kratky and H. Mark (Papier-Fabr., 1938, **36**, 345—348).—The cellulose mol. chains have varying plasticity on which depend such factors as the settling rate and η of cellulose solutions. The mechanism of the crystallisation of cellulose is discussed in various stages and a parallel drawn in the case of rubber in that a network of chain mols. is formed in each instance with parallel methods of linking between the chains. D. A. C.

Symbolic representation of crystalline form. H. Buttgenbach (Bull. Acad. roy. Belg., 1938, [v], **24**, 259—284).—In view of the present chaotic state of crystallographic expression, proposals for a unified scheme based on definite rules are defined in detail for the various crystal systems and their application to various typical crystals is given. N. M. B.

Structure of the insulin molecule. (Mrs.) D. M. Wrinch (J. Amer. Chem. Soc., 1938, **60**, 2005—2006).—The author's cyclol structure (A., 1937, I, 604) for insulin is in line with *X*-ray data (A., 1938, I, 300). R. S. C.

Structure of triterpenes and related substances. II. G. Giacomello (Gazzetta, 1938, **68**, 363—376).—Analysis of *X*-ray data shows that the hydrocarbon $C_{24}H_{18}$ obtained by dehydrogenation of triterpenes has a structure analogous to that of the triterpenes themselves. The structure of related substances is discussed. O. J. W.

Mol. wt. of fichtelite. (Miss) D. Crowfoot (J.C.S., 1938, 1241—1242).—Crystals of fichtelite on optical and *X*-ray evidence show close similarity to certain types of sterol crystal. From *X*-ray determination the dimensions of the unit cell are a 10·69, b 7·45, c 13·10 A., β 127° 5′, c sin β 10·45 A.; space-group $P2_1$, $n = 2$; ρ 1·045. Assuming 2 mols. per unit cell the mol. wt. is 264±4, in good agreement with 262 the formula wt. of $C_{19}H_{34}$. The probable mol. structure is



W. R. A.

Crystal structure of *cyclo*hexane and of some of its simpler derivatives. O. Hassel and A. M. Sommerfeldt (Z. physikal. Chem., 1938, **B**, **40**, 391—395).—In the neighbourhood of the m.p. the mols. in cubic crystals of *cyclo*-hexane, -hexanol, -hexanone, and chloro*cyclo*hexane possess considerable rotational freedom. The lattice consts. are 8·76, 8·83, 8·61, and 9·05 A., respectively. C. R. H.

***X*-Ray analysis of the structure of anthraquinone.** B. C. Guha (Phil. Mag., 1938, [vii], **26**, 213—223; cf. A., 1937, I, 401).—The C atoms of anthraquinone lie in one plane tilted from the (001) plane by 6° about each of the a, b, and c axes. The side rings of the mol. have internal angles 120° and side lengths 1·35 A. for the C:C and 1·46 A. for the C·C bonds. The middle ring has angles 109° between two single bonds, and 125° between a double and a single bond, with lengths of sides as in the outer rings. The O atoms are inclined unsymmetrically to the C plane. The C—O distances are 1·13 A. O. D. S.

Crystal structure of thianthren and selenanthren. J. E. Crackston and R. G. Wood (Nature, 1938, **142**, 257).—Thianthren, $a : b : c$ 2·37 : 1 : 1·95, β 110° 0′, a_0 14·3, b_0 6·09, c_0 11·8 A., and selenanthren, $a : b : c$ 2·36 : 1 : 1·97, β 110° 20′, a_0 14·5, b 6·21, c 12·1 A., both have space-group C_{2h}^5 and are isomorphous (cf. A., 1937, I, 448; 1938, II, 118). L. S. T.

Space group of creatinine. K. Banerjee and A. Haque (Indian J. Physics, 1938, **12**, 183—194).—The space-group is $C_{2h}^1/P/2m$; 8 mols. per unit cell; and a 14·86, b 13·14, c 5·85 A., β 110° 30′. W. R. A.

Crystal structure of condensed ring compounds. VI. 1 : 2-Benzanthracene, 5-methyl-1 : 2-benzanthracene, and 3-methyl-1 : 2-benzanthraquinone. J. Iball (Z. Krist., 1938, **99**, 230—237; cf. A., 1936, 1451).—*X*-Ray analysis yields for the respective monoclinic cells: a 7·91,

8·21, 7·52, *b* 6·43, 6·53, 16·81, *c* 23·96, 48·4, 11·63 A., β 99°, 90°, 118·9°; mols. per cell 4, 8, 4; ρ 1·245, 1·231, 1·393; probable space-group C_2^2—*P*2, C_{2h}^4—$P2/c$, C_{2h}^5—$P2_1/a$. Assuming plane C skeleton mols., orientations are discussed on the basis of estimated intensities, optical data, and general considerations. I. McA.

Crystal structure of cyanuric acid, $(CHON)_3$. E. H. Wiebenga and N. F. Moerman (Z. Krist., 1938, **99**, 217—229; cf. A., 1938, I, 125).—The pseudorhombic monoclinic cell has *a* 7·90, *b* 6·74, *c* 9·04 A., β ~90°; 4 $(CHON)_3$ per cell; space-group C_{2h}^6—$C2/c$. From *X*-ray intensities, cleavage, and twinning, layers parallel to (101) consist of plane triangle-cum-ring $(OC{\cdot}NH)_3$ mols. lacking the trigonal symmetry and CN link distinctions of cyanuric triazide (A., 1935, 1194). Interat. distances (C—N 1·36—1·37 A., C—O 1·24—1·31 A.) indicate resonance. Adjacent mols. in a layer are linked (O to N) by H bonds. I. McA.

Electron diffraction and surface structure. G. I. Finch (J.C.S., 1938, 1137—1146).—A lecture. W. R. A.

Structure of polished metal surfaces. E. Plessing (Physikal. Z., 1938, **39**, 618—620).—The results of Dobinski (A., 1937, 1, 227) for the structure of surfaces of Au and Ag under C_6H_6 determined by electron diffraction have been confirmed, but the data for Ni, Cu, and Fe do not agree with Dobinski's but with Raether's results (A., 1933, 1222). The effect of mechanical treatment on Au was investigated. A. J. M.

Photographic intensity measurements of electron-diffraction patterns. L. S. Ornstein, H. Brinkman, A. Hauer, and T. Tol (Physica, 1938, **5**, 693—700).—The relation between intensity and the resulting photographic density was determined for each observation for the same exposure time and electron velocity as was used for the diffraction photographs. Data for Ag and Cu films are described. The at. factor for electron diffraction shows a dependence on the angle of scattering different from that found by previous investigators. H. J. E.

Electron-diffraction investigation of aluminium chloride, bromide, and iodide. K. J. Palmer and N. Elliott (J. Amer. Chem. Soc., 1938, **60**, 1852—1857).—In the gaseous state the dimeric mols. consist of two tetrahedra sharing an edge with six halogen atoms at the corners, each tetrahedron containing one Al. Interat. distances are recorded for the three compounds. E. S. H.

Electron-diffraction investigation of the molecular structures of (1) phosphorus oxytrichloride, oxydichlorofluoride, oxychlorodifluoride, oxytrifluoride, fluorodichloride, pentafluoride, and trifluorodichloride, and of (2) disilane, trichlorosilane, and hexachlorodisilane. L. O. Brockway and J. Y. Beach (J. Amer. Chem. Soc., 1938, **60**, 1836—1846).—Interat. distances (in A.) and angles recorded are: PF_3, P—F 1·52±0·04, ∠FPF 104±4°; PCl_3 P—Cl 2·00±0·02, ∠ClPCl 101±2°; $PFCl_2$, P—F 1·55±0·05, P—Cl 2·02±0·03, ∠ClPCl 102±3°; POF_3, P—F 1·52±0·02, P—O 1·56±0·03, ∠FPF 107±2°; $POCl_3$, P—Cl 2·02±0·03, P—O (1·58), ∠ClPCl 106±1°; POF_2Cl, P—F 1·51±0·03, P—Cl 2·01±0·04, P—O 1·55±0·03, ∠FPF 106±3°; $POFCl_2$, P—F 1·50±0·03, P—Cl 1·99±0·04, P—O 1·54±0·03, ∠ClPCl 106±3°; PF_5, P—F 1·57±0·02, ∠FPF 90°, 120°, 180°; PF_3Cl_2, P—F 1·59±0·03, P—Cl 2·05±0·03, ∠FPF 120°, ∠ClPCl 180°; Si_2H_6, Si—Si 2·32±0·03, Si—H 1·47±0·03; $SiHCl_3$, Si–Cl 21·0±0·03, Cl—Cl 3·29±0·03, ∠ClSiCl 101±1°; Si_2Cl_6, Si—Si 2·32±0·06, Si—Cl 2·00±0·05. E. S. H.

Electron diffraction of dihalogen derivatives of *cyclo*hexane. J. G. Gudmundsen and O. Hassel (Z. physikal. Chem., 1938, **B**, **40**, 326—332).—Data for the vapours of six derivatives are recorded. C. R. H.

Electron-diffraction examination of linear high polymerides. K. H. Storks (J. Amer. Chem. Soc., 1938, **60**, 1753—1761).—Thin films of polyethylene succinate, adipate, and sebacate (I) and of natural gutta-percha (II) have been examined. Stretched films show diffraction patterns, characteristic of sharply oriented crystals, giving measurements in good agreement with existing *X*-ray data. Unstretched films of (II) are composed of relatively large crystallites, oriented with their fibre axis directions normal to the film surface. Unstretched films of (I) consist of relatively small crystals, apparently oriented with their fibre axis directions approx. in the plane of the film, but with limited rotation around the fibre axis directions. E. S. H.

Diffuse scattering of *X*-rays from piezo-electrically oscillating quartz. G. E. M. Jauncey and W. A. Bruce (Physical Rev., 1938, [ii], **54**, 163—165).—Different modes and types of vibration have no effect on the intensity of the diffuse scattering, and since the latter cannot be affected by secondary extinction it is concluded that the change of intensity of the Laue spots (cf. A., 1936, 273) is due to a decrease of secondary extinction in the body of the crystal. N. M. B.

Paramagnetism of electrons in a rectangular band. L. Néel (Compt. rend., 1938, **206**, 1471—1473).—Theoretical. The magnetic properties of metals of the Fe group are discussed. A. J. E. W.

Magnetic after-effect. S. Koch (Naturwiss., 1938, **26**, 493—494).—A theory of the magnetic after-effect which takes into account the connexion with the mechanical after-effect is put forward. A. J. M.

Ferromagnetic Curie point as a phase transition of the second kind. J. de Boer and A. Michels (Physica, 1938, **5**, 775—776).—Data for Ni, although insufficient for a definite conclusion, are of the right order of magnitude. H. J. E.

Break in the magnetisation curve of iron single crystals in weak magnetic fields. K. Honda and T. Nishina (Z. Physik, 1938, **109**, 758—761).—The magnetisation curves for Fe single crystals along the 3 principal axes are determined with a high-sensitivity astatic magnetometer. The curves are collinear up to a crit. field strength at which point they diverge, the susceptibility then changing for each orientation. The results are explained in the light of the Honda–Ôkubo theory of paramagnetic substances. L. G. G.

Resistance, spontaneous magnetisation, and Curie point of nickel. W. GERLACH, H. BITTEL, and S. VELAYOS (Sitzungsber. bayr. Akad. Wiss., 1936, 81—136; Chem. Zentr., 1936, ii, 2309).—The R–θ curves for impure samples of Ni can be obtained by the application of Matthiessen's additive rule to the corresponding curve for pure Ni. This conclusion is confirmed by measurements on pure and impure specimens of Ni at −200° to 600°. The results are discussed in relation to anomalies in R and spontaneous magnetisation; the work of Borelius (cf. A., 1931, 552) is also discussed. Spontaneous magnetisation occurs considerably above the temp. regarded as the Curie point of Ni. A. J. E. W.

Determination of elasto-optical constants with supersonic waves. H. MUELLER (Z. Krist., 1938, **99**, 122—141; cf. A., 1937, I, 505; 1938, I, 129; Bergmann and Fues, B., 1936, 1093).—The mathematical theory of the optical effects of ultrasonics in cubic crystals and amorphous solids is further reviewed with reference to the dependence of intensity and polarisation of the diffracted beam pattern on the elastic and elasto-optical consts. of the medium. On this basis, the intensity and polarisation for NaCl, KCl, and CaF_2 crystals are calc. from measurements (Voigt, Pockels) of the consts.; three experimental methods are discussed for the (general) converse problem. I. McA.

Optical observation of the Debye heat waves in crystals. (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1938, **142**, 250).—Photographs showing the interference pattern of the 4046 A. radiation of a H_2O-cooled Hg lamp scattered by thermal agitation in a crystal of gypsum, and demonstrating the physical reality of the Debye heat waves in crystals, are submitted. The displacements of the three components into which the incident radiation is split correspond with acoustic wave velocities of 3350, 2050, and 1100 m. per sec., respectively. L. S. T.

Recrystallisation diagram of cadmium. J. CZOCHRALSKI and T. MIAZGA (Wiadom. Inst. Met., 1935, **2**, 3—5; Chem. Zentr., 1936, ii, 433—434).—A diagram is constructed from grain-size measurements for compressively deformed Cd which was allowed to recrystallise for 30 min. at 20°, 50°, 100°, 150°, 200°, 250°, 300°, and 310°. H. J. E.

Elastic constants of transparent isotropic solids by a new method. K. H. HOESCH (Z. Physik, 1938, **109**, 606—624).—Elastic waves are generated in glass blocks by affixing the latter to vibrating quartz crystal, suitable apparatus for the excitation of which is described in detail. Polarised light passed through the glass blocks is examined microscopically and the mean distance between the resultant striations is determined. Hence the velocity of propagation of the waves in the glass is calc., and the moduli of elasticity and torsion are obtained to an accuracy of 0·6% and the Poisson const. to 1·4%. L. G. G.

Effect of pressure on elastic parameters of isotropic solids. F. BIRCH (J. Appl. Physics, 1938, **9**, 279—288).—Murnaghan's theory (Amer. J. Math., 1937, **59**, 235) of finite strain is applied to determine the effect of hydrostatic pressure on the elastic coeffs. of an isotropic body for further applied strains of small magnitude. The stress–strain relations are the same as those of the classical theory, but with elastic parameters which depend on the pressure. The observed pressure coeffs. are in agreement with the calc. vals. J. A. D.

X-Ray diffraction study of sulphur allotropes. S. R. DAS (Indian J. Physics, 1938, **12**, 163—181).—The structures of various S allotropes have been investigated by Hull's diffraction method between −183° and 130°. Roll S, flowers of S, milk of S, and the gummy deposits of colloidal S are cryst. and similar in structure to S_α (orthorhombic S). Freshly-prepared plastic S is amorphous but is readily transformed into a hard, solid, CS_2-insol. substance (I) of structure similar to S_α. When (I) is kept at about 60°, or treated with aq. NH_3, it becomes sol. in CS_2. White S, from hydrolysis of S_2Cl_2, gives a well-defined pattern, quite different from that of S_α; it is insol. in CS_2 but, when heated for some time at 88°, is changed completely into S_α. Data on S_β (monoclinic) could not be obtained but patterns of liquid S for 114°, 119°, and 128° are given. At low temp. (to −183°) no change in structure of solid S is found. The solubility of the various forms in CS_2 is discussed. For each insol. variety SO_2 always takes part in the reaction involved and it is suggested that SO_2 forms a protective layer on the surface of the crystals. W. R. A.

Mol. wts. of globular proteins. (MRS.) D. M. WRINCH (Phil. Mag., 1938, [vii], **26**, 313—332).—The predictions and general point of view of the cyclol theory agree well with the data of Svedberg. A consideration of the shape of the C_n cyclols and the nature of the cyclol network indicates that compound cyclols may exist. The actual nos. given by Svedberg for 14 different mol. wt. classes may all be represented by simple or compound cyclols, assuming that the corresponding apparent residue wts. lie between 121 and 128. A simple interpretation of the reversible dissociation, characteristic of many proteins, has been suggested which explains in particular the effect of dilution and changes in p_H on the mol. wts. of such proteins. For virus proteins and other heavy proteins, a cage-colony structure has been proposed. W. R. A.

Electrical conductivity of lead crystals at low temperatures in strong transverse magnetic fields. E. JUSTI and H. SCHEFFERS (Physikal. Z., 1938, **39**, 591—597).—The resistance of two Pb crystals with the 100 and 111 axes approx. parallel has been determined at 1·8—20° K. under the action of a strong transverse magnetic field (31,000 gauss). The increase of resistance at 14—20° K. on applying the field is comparatively small and isotropic in agreement with the low characteristic temp., but at the temp. of boiling He it increases considerably and shows increasing anisotropy with greater field strength. The residual resistance, defined as the difference between the measured and the ideal resistance, decreases considerably with falling temp. even before the onset of superconductivity. The mean relative

increase in resistance is a function of the ratio of the field strength to the resistance without the field. A. J. M.

Co-existence of normal and superconductive regions. K. MENDELSSOHN and J. G. DAUNT (Phil. Mag., 1938, [vii], **26**, 376—380).—Experimental proof is given for an isothermal co-existence of superconductive and normal material in the same specimen. The time effects in superconductors are discussed with regard to such a co-existence. W. R. A.

"Overshoot phenomenon" in superconductivity. A. D. MISENER (Proc. Camb. Phil. Soc., 1938, **34**, 465—469).—Transition curves are obtained for a sample of Ta wire (length 6 cm., diameter $7{\cdot}5 \times 10^{-3}$ cm.) at const. temp. and zero external magnetic field by increasing the current, and also by increasing the external field with const. current. Resistance becomes unsteady after ~10% of the resistance of the specimen had been restored. This unsteadiness and the "overshoots" observed with coiled specimens occur in the same regions of the transition curve and are probably due to a secondary effect in the transition from the superconducting to the nonsuperconducting state. F. J. L.

Method of least squares and the thermo-electric power of rhodium. H. T. WENSEL and L. B. TUCKERMAN (Rev. Sci. Instr., 1938, **9**, 237—241).—Polemical. Proper application of the method of least squares to the data of Booth and Dixon (A., 1937, I, 606) indicates that their conclusions are not justified; this is supported by other evidence. Other reported irregularities in the behaviour of Rh near 1100° can be ascribed to the formation and decomp. of a surface film of Rh_2O_3. (Cf. following abstract.) W. R. A.

Discontinuity in the thermo-electric power of rhodium. E. T. BOOTH and E. M. DIXON (Rev. Sci. Instr., 1938, **9**, 242—243).—A reply to criticism. (Cf. preceding abstract.) W. R. A.

Thermomagnetic anomaly shown at room temperatures by microcrystalline ferromagnetic substances. A. MICHEL and (MLLE.) M. GALLISSOT (Compt. rend., 1938, **207**, 140—142).—A relationship between the magnetism–temp. curve and the microcryst. nature of the specimen has been indicated (A., 1938, I, 421). Microcryst. ferrites of Ni, Cu, and MgO have been investigated. There is no single definite Curie point for a substance; instead the Curie temp. extends over a small range. Both chemical and physical heterogeneity cause changes in the curvature of the magnetism–temp. curve. W. R. A.

Cause of the [magnetic] anomaly in magnetite at low temperatures. R. FORRER (Compt. rend., 1938, **207**, 281—283).—Natural Fe_3O_4 gives an anomalous increase in χ with increasing temp. between −138° and −118°, which is ascribed to the breaking at low temp. of linkings between pairs of Fe atoms in the lattice. A second form of Fe_3O_4 (cf. Hilpert, A., 1937, I, 421) which reacts readily with Cl_2 does not give this anomaly, indicating the absence of Fe–Fe linkings. Ferrites (in which such linkings cannot occur) give no anomaly. A. J. E. W.

Ferromagnetic and electrical properties. VIII. Longitudinal and transverse thermomagnetic effects of nickel. P. WAGNER (Ann. Physik, 1938, [v], **32**, 665—682; cf. A., 1932, 900).—The saturation val. E_∞ of the thermomagnetic e.m.f. of a Ni wire, when one end is at temp. $> \Theta$, the Curie temp., and the other at temp. $T < \Theta$, is given by $E_\infty = C(\Theta - T)^2$, where C is a const. dependent on the purity of the Ni. The transverse e.m.f., $E_\perp$, has opposite sign to the longitudinal, $E_\parallel$, but is of equal magnitude. By the application of longitudinal stress $E_\parallel$ is increased to a saturation val., $2E_\parallel$, while $E_\perp$ decreases towards zero. At high field strengths both $E_\parallel$ and $E_\perp$ decrease with increasing field. At small temp. difference and under stress $E \propto I^2$, where I is the magnetisation. O. D. S.

Magneto-resistance change of ferromagnetics in an alternating magnetic field. S. SHARAN (Indian J. Physics, 1938, **12**, 203—210).—The effects produced on the resistance of Ni and of Ni–Fe permalloy by an alternating magnetic field and by an alternating and direct field simultaneously have been investigated. W. R. A.

Mechanical and magnetic secondary effect of carbonyl iron. G. RICHTER (Ann. Physik, 1938, [v], **32**, 683—700).—A torsional secondary effect has been observed in wires of carbonyl iron with temp. variation similar to that of the magnetic secondary effect previously described (B., 1937, 1059). It is suggested that both are due to thermal fluctuations in the crystal lattice and the activation energy is calc., from the temp. coeff. of the velocity of establishment of the effect, to be 20 kg.-cal. per mol. O. D. S.

Paramagnetic relaxation. P. DEBYE (Physikal. Z., 1938, **39**, 616—618).—Theoretical. A. J. M.

Paramagnetic dispersion in chromium alum and its interpretation. C. J. GORTER, P. TEUNISSEN, and F. BRONS (Physica, 1938, **5**, 657—662).—Measurements at 77° and 90° K., and with field strengths of 800, 1600, 2400, and 3200 oersted, are recorded. The results are discussed in terms of the theories of Casimir and of Kronig. H. J. E.

Magnetic properties and structure of manganous and cobaltous dipyridine chlorides. D. P. MELLOR and C. D. CORYELL (J. Amer. Chem. Soc., 1938, **60**, 1786—1787).—Magnetic measurements indicate that the Mn and Co atoms in the above compounds form ionic rather than covalent dsp^2 linkings. It is suggested that an octahedral ionic type of structure occurs in the Mn and α-Co compounds and a tetrahedral ionic type in the β-Co compound. E. S. H.

Magnetic susceptibilities of certain inorganic complex compounds. J. H. FRAZER and N. O. LONG (J. Chem. Physics, 1938, **6**, 462—465).—The method employed for determining gyromagnetic effect has been adapted to measure the magnetic susceptibilities (χ) of some inorg. substances at 27° in a weak field (approx. 300 oersted) using 0·5 g. of material. Constructional and operational details are given. NaNO, prepared by passing dry NO into a solution of Na in liquid NH_3 and evaporating NH_3, is diamagnetic. *Na nitrosopentanitrocobaltiate dihydrate*,

$Na_3[Co(NO)(NO_2)_5],2H_2O$ (I), and *nitrosopentammine Co dichloride*, $[Co(NO)(NH_3)_5]Cl_2,5H_2O$ (II), have been investigated. (II) is paramagnetic; (I) is diamagnetic in weak fields but becomes paramagnetic as the field strength is raised. A tentative explanation of the χ of the three compounds is given. W. R. A.

Magnetic properties of ferric hydroxide. R. CHEVALLIER and (MLLE.) S. MATHIEU (Compt. rend., 1938, **206**, 1469—1471).—The val. of χ for the hydroxide pptd. by KOH from $Fe_2(SO_4)_3$ solutions and washed and dried under fixed conditions shows large variations with the initial concns. used, and with the ratio of KOH to Fe on pptn. The Fe_2O_3 obtained on heating gives a const. val. of χ. A. J. E. W.

Paramagnetic magneton numbers of the ferromagnetic metals. E. C. STONER (Proc. Leeds Phil. Soc., 1938, **3**, 457—464).—The results of Sucksmith (cf. A., 1938, I, 71) for Fe, Co, and Ni are discussed in the light of a collective electron treatment of ferromagnetism using Fermi–Dirac statistics. The general character of the $1/\psi$–T curves is in agreement with this treatment. Estimates of the ratio of the interchange interaction energy to the Fermi energy can be made from the results, and the Fermi energy so obtained for Ni is in good agreement with the val. deduced from the electronic sp. heat at low temp. N. M. B.

Change of thermal energy with adiabatic change of magnetisation in iron, nickel, and carbon steel. T. C. HARDY and S. L. QUIMBY (Physical Rev., 1938, [ii], **54**, 217—223).—The change in thermal energy which occurs when the magnetisation is altered adiabatically is traced for each material, through a complete half-cycle of magnetisation which starts with the max. val. of the intensity of magnetisation. The external work done by the specimen at each stage is evaluated. The decrease in thermal energy on demagnetisation is $<$ the external work done by the specimen in Fe and steel, and greater in unannealed Ni; in annealed Ni it is greater when magnetisation is continuous and less when it is discontinuous. N. M. B.

Time effects in magnetisation. J. L. SNOEK (Physica, 1938, **5**, 663—688).—A theory is developed which accounts for the phenomena of magnetic viscosity and the reversible decrease of permeability with time. Confirmatory measurements on carbonyl Fe are described. H. J. E.

Raman and Nath's theory of the diffraction of light by ultrasonic waves. R. BÄR (Helv. Phys. Acta, 1936, **9**, 265—284; Chem. Zentr., 1936, ii, 931—932).—The theory was verified for xylene with a frequency of 1500 kHz. and using a Hg lamp as light source. It was qualitatively applicable at a frequency of 7500 kHz. H. J. E.

Mathematical theory of diffraction of light by ultrasonic waves. G. WANNIER and R. EXTERMANN (Helv. Phys. Acta, 1936, **9**, 337—339; Chem. Zentr., 1936, ii, 2284—2285).—The frequency of the diffracted light is given by $\omega_n = \omega_0 + n\nu$ (ν = sound frequency). Intensities of diffracted light are calc. and compared with Raman and Nath's theory. A. J. E. W.

Diffraction of light by ultrasonic waves in air. R. BÄR (Helv. Phys. Acta, 1936, **9**, 367—371; Chem. Zentr., 1936, ii, 2285).—First- and second-order diffracted spectra have been obtained. Variations in n of $\pm 1{\cdot}3 \times 10^{-6}$, corresponding with a pressure variation of $4{\cdot}8 \times 10^{-3}$ atm., are recorded. Ultrasonic velocities in gases may be determined by the method used (cf. A., 1937, I, 174). A. J. E. W.

Interference of two plane ultrasonic waves. Application of this phenomenon in a new method of measuring the velocity of sound. J. P. CANCE (J. Phys. Radium, 1938, [vii], **9**, 308—312).—Details of the method (cf. A., 1938, I, 239) are given. The velocities of sound in PhMe and Hg are 1314 and 1442 m. per sec., in agreement with recorded data. W. R. A.

Sound velocity in heavy water and compressibility. K. YOSIOKA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 843—853).—The sound velocity, V, in H_2O and in D_2O has been determined at temp. between 25° and 90° at a frequency of 4900 kc., by an optical method utilising the diffraction of light caused by a train of supersonic waves. The max. val. of V is reached at a temp. in $D_2O >$ in H_2O, whilst the adiabatic compressibility (κ), calc. in both cases from V and d, reaches a min. val. at a temp. in $D_2O >$ in H_2O. By extrapolation the following data have been found for pure D_2O at 25°: V, 1398·6 m. per sec.; κ, $46{\cdot}27 \times 10^{-12}$ dyne^{-1}, and isothermal compressibility, $46{\cdot}49 \times 10^{-12}$ dyne^{-1}. W. R. A.

Velocity of sound in liquid oxygen. H. W. LIEPMANN (Helv. Phys. Acta, 1936, **9**, 507—510; Chem. Zentr., 1936, ii, 3051).—Measurements for a frequency of 7500 kHz. are recorded. The velocity at −183·6° was 903 m. per sec. and at −209·5°, 1111 m. per sec. The adiabatic compressibility was calc. The piezo-electric properties of the quartz used persisted to −212°. H. J. E.

Ultrasonic radiation field of a quartz disc radiating into liquid media. F. E. FOX and G. D. ROCK (Physical Rev., 1938, [ii], **54**, 223—228).—The radiation pressure of sound waves on a spherical obstacle is used to determine the distribution of intensity in the sound field of a quartz disc radiating into H_2O. Results are in agreement with theory. N. M. B.

Refractive index of air in the visible and photographic infra-red. D. BENDER (Physical Rev., 1938, [ii], **54**, 179—183).—Measurements of n for dry air free from CO_2 were made from 5300—11,177 A., and a dispersion formula for 0° and 760 mm. is given. A calculation indicates that the O_2 absorption band at 7600 A. has no measurable effect on the dispersion of air. N. M. B.

Specific heats of beryllium, phosphorus, and titanium nitrides. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 888—896).—Using the ice calorimeter and Al as standard the sp. heats of Be_3N_2 (0—95°, 0—303°, 0—500°), P_3N_5 (0—99·6°, 0—305°), and TiN (as P_3N_5 and 0—500°) are respectively $0{\cdot}2726 + 7{\cdot}884 \times 10^{-4}t - 5{\cdot}163 \times 10^{-7}t^2$; $0{\cdot}2027 + 6{\cdot}252 \times 10^{-4}t$; and $0{\cdot}1410 + 1{\cdot}918 \times 10^{-4}t - 1{\cdot}127 \times 10^{-7}t^2$. W. R. A.

Atomic heats of nitrogen in various nitrides. I. S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 751—760).—The at. heats of N in B, Al, Si, Ca, V, Mo, and Ta nitrides at 25°, 100°, 300°, and 500° have been calc. from measurements of the mol. heats of the nitrides, and the at. heats of the elements concerned. The mean val. of the at. heat for the range 0—100° was about 2·4 for the nitrides of the elements of low at. no., B, Al, Si, whilst for these of higher at. no. it varied from 3·26 for VN to 4·49 for Ca_3N_2. The temp. coeff. for the first group was low, the at. heat increase from 25° to 500° being about 1·85 units, whereas in the other group the increase was 3·257 for TaN, 3·963 for VN, and 4·766 for Mo_2N, Ca_3N_2 with 1·76 being exceptional. The mean val. for 0—100° is a periodic function of the at. no. of the elements. R. C. M.

Heat capacity and entropy of barium fluoride, cæsium perchlorate, and lead phosphate. K. S. PITZER, W. V. SMITH, and W. M. LATIMER (J. Amer. Chem. Soc., 1938, **60**, 1826—1828).—Heat capacity data for the range 15—300° K. are recorded. The calc. mol. entropies at 298·1° K. are: BaF_2 23·03±0·1, $Pb_3(PO_4)_2$ 84·45±0·4, $CsClO_4$ 41·89±0·2 g.-cal. per degree. E. S. H.

Entropy of ethyl alcohol from molecular data and the equilibrium in the hydration of ethylene. S. C. SCHUMANN and J. G. ASTON (J. Chem. Physics, 1938, **6**, 480—484).—The entropy and free energy of EtOH gas have been calc. from mol. data at several temp. on the basis of both free internal and restricted rotation. For restricted rotation hindering potentials of 3000 g.-cal. about the C·C bond and 10,000 g.-cal. about the C·O bond were assumed. The vals. for restricted rotation agree well with those obtained from the third law and from the equilibrium data on the hydration of C_2H_4. W. R. A.

Entropy of acetone and *iso*propyl alcohol from molecular data. Equilibrium in the dehydrogenation of *iso*propyl alcohol. S. C. SCHUMANN and J. G. ASTON (J. Chem. Physics, 1938, **6**, 485—488).—The discrepancies between the entropy vals. of $COMe_2$ and of $Pr^{\beta}OH$ gases, obtained by calculation from the third law of thermodynamics and from mol. data, can be explained by assuming restricted rotation in the mols. using the following restricting potentials: $COMe_2$, about the C·C bond 1000 g.-cal.; $Pr^{\beta}OH$, about the C·C 3400 and about C·O 5000 g.-cal. W. R. A.

Communal entropy and the theory of fusion. O. K. RICE (J. Chem. Physics, 1938, **6**, 476—479).—The concept of "communal" entropy (A., 1938, I, 73) is discussed. Theoretically and empirically the entropy of fusion of simple solids is not primarily concerned with the excitation of communal entropy as suggested by Eyring *et al.* (*loc. cit.*). The nature of the communal entropy and its manner of excitation are discussed. W. R. A.

Depression of the m.p. by mixed structure of molecules of crystalline solid and crystalline liquid substances. D. VORLÄNDER [with K. OST] (Ber., 1938, **71**, [*B*], 1688—1710).—The following points are treated experimentally and theoretically; depressions of the m.p. by transition from solid crystals to the amorphous melt; anomalies of the depression of the f.p. in the cryoscopic determination of mol. wt.; comparison of the eutectic with the isotectic in the transition from the solid crystal to the amorphous melt; behaviours of mixtures of "children" in the transition from solid crystals to cryst. liquids and to amorphous melts (cryst. liquid *Pl*-form of the type of *p*-azoxyphenol ethers; cryst. liquid *Bz* form of the type of Et *p*-azoxybenzoate; cryst. liquid mixtures and "children" from *Pl* and *Bz* forms; m.p. diagrams of cryst. mixtures in connexion with the structural relationships between "parents" and "children." The original should be consulted for details. The following are described incidentally: p-*phenetoleazo*-p-*anisole*, m.p. 135—136°; *Et* p-*phenetole*-p-*azobenzoate*, m.p. 119°, and the corresponding *acid*, m.p. 215—217° and 254—257°; p-*ethoxybenzylidene*-p'-*phenetidine*, m.p. 148—149°; p-*anisylidene*-p'-*phenetidine*, m.p. 128—129°; p-*ethoxybenzylidene*-p'-*anisidine*, m.p. 122—123°. H. W.

M.p. of paraffins and fatty acids. E. B. MOULLIN (Proc. Camb. Phil. Soc., 1938, **34**, 459—464).—The relationships between the no. (N) of C atoms in paraffin and fatty acid chains and their m.p. (θ) are shown to be (*a*) for paraffins, $\log(N-2) = 1{\cdot}065+5{\cdot}290/10^3$, (*b*) for fatty acids, N odd, $\log(2N-2)=1{\cdot}14+5{\cdot}80/10^3$, (*c*) N even, $\log(2N-2)=1{\cdot}02+7{\cdot}20/10^3$. F. J. L.

Thermal hysteresis of the methane transition at 20·4° K. A. EUCKEN and E. BARTHOLOMÉ (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II, 1936, **2**, 51—64; Chem. Zentr., 1936, ii, 773—774).—Heuse's observation of a hysteresis effect (A., 1930, 677) was confirmed. The hysteresis effect is reduced by a temporary interruption of the cooling process above the transition point. The max. sp. heat at the transition point is 120 g.-cal. per mol. The cause of the hysteresis is discussed. H. J. E.

Vaporisation experiments in vacuum with polonium, radium-*D*, and radium-*E*. M. HOFFER (Sitzungsber. Akad. Wiss. Wien, II*a*, 1935, **144**, 393—396; Chem. Zentr., 1936, ii, 1691; cf. A., 1937, I, 99).—Po vaporises at a temp. 300° < that for Ra-*D* and 250° < for Ra-*E*. H. J. E.

Vaporisation experiments with polonium in oxygen and nitrogen. E. RONA and M. HOFFER (Sitzungsber. Akad. Wiss. Wien, II*a*, 1935, **144**, 397—402; Chem. Zentr., 1936, ii, 1691).—Po vaporises at a lower temp. in N_2 than in O_2. H. J. E.

Solid-liquid equilibrium in argon. O. K. RICE (J. Chem. Physics, 1938, **6**, 472—475).—The internal equilibrium between the solid and liquid phases of A is investigated by the method applied to N_2 and O_2 (A., 1937, I, 398). The intersection of the curves for the thermodynamic quantities $T(\partial S/\partial V)_T$ and $(\partial E/\partial V)_T+P$, plotted as functions of the vol., determine the conditions of equilibrium of the system. The functions $(\partial S/\partial V)_T$ and $(\partial E/\partial V)_T$, assumed dependent on vol. but independent of temp., are plotted against vol. and give curves which reproduce approx. most of the melting parameters of A

at high pressures. The significance of these curves is discussed. W. R. A.

Nernst heat theorem and irreversible processes at low temperatures. A. R. UBBELOHDE (Phil. Mag., 1938, [vii], **26**, 260—268; cf. A., 1937, I, 571).—It is suggested that for systems obeying the Nernst heat theorem the probability of spontaneous change in the system will decrease rapidly on approaching 0° K. The application of this extension of the theorem to electrical resistance, thermal conductivity, and viscosity is discussed. O. D. S.

Relations between Stefan's radiation law, Nernst's heat theorem, and Maxwell's formula for the radiation pressure. E. GUTH and A. E. HAAS (Proc. Nat. Acad. Sci., 1938, **24**, 224—227).—Theoretical. E. S. H.

Modernised version of Gibbs' use of the grand canonical ensemble. R. H. FOWLER (Proc. Camb. Phil. Soc., 1938, **34**, 382—391). F. J. L.

Avogadro number with absolute significance and a derived equation of state for perfect gases. L. LABOCETTA (Ric. Sci. Progr. tecn., 1936, [ii], **7**, I, 50—51; Chem. Zentr., 1936, ii, 759).—Theoretical. H. J. E.

Corresponding-states equation of practical interest for general physico-chemical computations. F. G. KEYES (J. Amer. Chem. Soc., 1938, **60**, 1761—1764).—Fugacity–pressure ratio charts for const. reduced temp. against reduced pressures lead at low pressures to a simple reduced equation of state. The consts. of this equation have been evaluated and show differences between polar and non-polar gases. The equation has been applied to certain equilibria and the results indicate that it is useful for making approx. physico-chemical calculations involving gases under pressure. E. S. H.

Pressure coefficient of thermal conductivity of metals. C. STARR (Physical Rev., 1938, [ii], **54**, 210—216).—Determinations were made for Cu, Ag, and Au by means of an improved longitudinal heat flow method. Results indicate that the Wiedemann–Franz ratio over a pressure range of 12,000 kg. per sq. cm. has a small positive coeff. of approx. 1% in 10,000 kg. per sq. cm., disagreeing with Bridgman, who found that the coeff. may be negative or positive. Experiments show that these negative coeffs. were due to a systematic convection error. The positive coeff. is attributed to the non-electronic part of the thermal conductivity. N. M. B.

Thermal conductivity of metals. R. E. B. MAKINSON (Proc. Camb. Phil. Soc., 1938, **34**, 474—497).—Theoretical. Formulæ for the heat currents transported by the electrons (κ_e) and by the lattice (κ_g) are derived. κ_g is unimportant at any temp. in univalent metals, but plays a major part in Bi at low temp. The scattering of lattice waves at the boundaries of single crystals (including insulators) at low temp. is also considered. F. J. L.

Temperature coefficient of compressibility and the kinetics of liquids. F. E. YENICAY (Rev. Fac. Sci. Istanbul, 1938, **3**, 255—262).—Mathematical. Liquids are in an intermediate, transition state between the stable, structurally well-defined solid and gaseous states. They possess different structures at each different temp. T. H. G.

Viscosity of liquid helium. W. H. KEESOM and G. E. MACWOOD (Physica, 1938, **5**, 737—744).—Apparatus of the oscillating-disc type for the measurement of η of liquid gases, interchangeably, is described. Measurements with He at 1·2—4·0° K. are recorded. There was no evidence that He II shows slip. η goes to zero as T approaches 0° K. H. J. E.

Viscosity of liquid hydrogen. W. H. KEESOM and G. E. MACWOOD (Physica, 1938, **5**, 745—748).—Measurements by the oscillating-disc method at 14·8—20·0° K. gave 215·0 to 138·8 μ-poise. H. J. E.

Viscosity of hydrogen vapour. W. H. KEESOM and G. E. MACWOOD (Physica, 1938, **5**, 749—752).—Measurements of the η of the saturated vapour of H_2 at 14·5—20·3° K. are recorded. H. J. E.

Reaction rate theory of viscosity. R. H. EWELL (J. Appl. Physics, 1938, **9**, 252—269).—A theory of chemical reaction rates, based on the physical conception of potential energy barriers, is applied to evaluate the coeffs. of viscosity, plasticity, and diffusion of liquids, resins, and glasses. The relation between viscosity and v.p., and the effect of external pressure on viscosity, are considered. The theory can be applied to all flow phenomena including creep in metals, diffusion in crystals, and the electrical conductivity of glasses, liquids, and ionic solutions. J. A. D.

Viscosities of hydrocarbons. IV—VI. E. B. EVANS (J. Inst. Petroleum Tech., 1938, **24**, 321—337; cf. A., 1938, I, 305).—Vals. of the abs. and kinematical viscosities at 0—100° are tabulated for *iso*paraffins, monocyclic naphthenes including *cyclo*pentane and -hexane and derivatives containing 5—32 C, acyclic and cyclic olefines. Details are given of the prep. and physical properties of the *cyclo*pentane and -hexane hydrocarbons. J. S. G. T.

Thermal diffusion of colour centres in potassium chloride crystals at various concentrations. O. STASIW (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., II [N.F.], 1936, **2**, 131—137; Chem. Zentr., 1936, ii, 3058—3059).—Diffusion measurements are recorded. The vals. at low temp. are > the vals. expected from an extrapolation of high-temp. data. H. J. E.

Self-diffusion in solids. G. HEVESY (Trans. Faraday Soc., 1938, **34**, 841—845).—The use of radioactive isotopes as indicators is extended to experiments on diffusion in solids. The view that the diffusion rate in solids is dependent on the distribution of the electrical forces around the atoms explains the observed low diffusion coeffs. of Pb and accounts for the high diffusion rate of Au in solid Pb. Similar methods determine the self-diffusion rate of Pb^{++} in solid $PbCl_2$ and PbI_2. Results permit the accurate calculation of the transference no. of Pb^{++}. W. R. A.

Self-diffusion coefficient of gold. H. A. C. MCKAY (Trans. Faraday Soc., 1938, **34**, 845—849).—The self-diffusion coeffs. (D) of Au have been measured

for the temp. range 721—966° by two methods which are described. The vals. from both methods do not agree; these, and their differences, are discussed. W. R. A.

System sulphuric acid–ethers. II. System sulphuric acid–propyl ether. S. K. K. JATKAR and N. G. GAJENDRAGAD (J. Indian Inst. Sci., 1938, **21A**, 77—87).—The val. of η shows a pronounced max. at H_2SO_4,Pr^n_2O (cf. A., 1938, I, 141). Deviations of the fluidity from additivity show max. at $H_2SO_4,2R_2O$ (R = Me, Et, Pr^n). Vals. of sp. conductivity (which shows a max. at 92·6% H_2SO_4) and of d are recorded for H_2SO_4–Pr^n_2O mixtures. F. R. G.

Diamagnetic susceptibility of formic acid–water mixtures. S. R. RAO and S. SRIRAMAN (J. Annamalia Univ., 1938, **7**, 187—193).—The susceptibilities (χ) of aq. solutions of HCO_2H containing 29—79 wt.-% HCO_2H have been measured by a Curie balance at 26°. Pure HCO_2H has $\chi = 0{\cdot}4464$. The results show a deviation (>5%) from the additivity law and this may indicate the formation of a monohydrate. Alternately, the deviation may be due to partial association of HCO_2H mols. W. R. A.

Indium–lead system. S. VALENTINER and A. HABERSTROH (Naturwiss., 1938, **26**, 517).—Thermal analysis indicates the formation of a cryst. phase represented by Pb_6In_{26}. This is confirmed by X-ray analysis. Pure In or In with >10 at.-% Pb has a face-centred tetragonal lattice with c/a 1·08, but at about 10 at.-% Pb a second face-centred tetragonal lattice with c/a 0·94 makes its appearance, and is the only phase at 20 at.-% Pb. At 27 at.-% Pb the Pb lattice appears with consts. 2% < those of pure Pb. A. J. M.

Theory of the thermoelectric properties of alloys. T. MUTO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 741—750).—Mathematical. R. C. M.

Decomposition of the solid solution of copper in aluminium as a result of plastic deformation with subsequent annealing. S. KONOBEJEWSKY and M. SACHAROSA (Metallwirts., 1936, **15**, 412—417; Chem. Zentr., 1936, ii, 1681).—X-Ray measurements on mixed crystals with 5, 4, and 2% of Cu are recorded which show the influence of temp. and time of annealing on the decomp. H. J. E.

State of the nickel atom in the γ-phase of the Ni–Zn system. J. DORFMAN and S. SIDEROV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 381—382).—The magnetic moment of the Ni atom in the γ-phase of the Ni–Zn alloy (16·1—20·25 at.-% Ni) is zero, indicating that the atom is neutral and in the $^1S_0$ state. This is in agreement with the Hume-Rothery rule. F. J. L.

Effect of uniform pressure on the Curie temperature. H. EBERT and A. KUSSMANN (Physikal. Z., 1938, **39**, 598—605).—The variation of the ferromagnetic magnetisation of Ni–Cu, Ni–Al, and Ni–Fe alloys with pressure (up to 4000 kg. per sq. cm.) and temp. has been studied. At low temp. the influence of pressure on the magnetisation diminishes. The influence of pressure on the Curie point increases with rising temp., the effect being the more marked the nearer the Curie point is approached. It is not possible to eliminate the ferromagnetism by the application of any finite pressure. A. J. M.

Difficulties in the preparation of mixed crystals with silver chloride. V. CAGLIOTI (Congr. int. Quim. pura apl., 1934, **9**, II, 471—482; Chem. Zentr., 1936, ii, 2301).—Drawn AgCl fibres show fibrous structure parallel to [100] and [111], the former alone remaining after recrystallisation at 320°. Working the fibres lowers the temp. at which they must be heated to restore the original hardness of the AgCl. Small additions of other halides (*e.g.*, 0·01% CuCl, $CaCl_2$, or $MgCl_2$; 0·04% RbCl) render the AgCl unworkable. A. J. E. W.

Singular elements of the region of stratification of ternary systems. K. I. MOTSCHALOV (J. Gen. Chem. Russ., 1938, **8**, 529—537).—Phase diagrams for the system Ac_2O–H_2O–CS_2 are given for 0°, 18°, and 24°, and the surface tensions at the various phase interfaces are recorded. R. T.

Stable equilibria of liquid phases in the quaternary system glycerol–acetone–water–acetic anhydride. K. K. PONOMAREV (J. Gen. Chem. Russ., 1938, **8**, 544—551).—Equilibrium relations have been studied at 20°. R. T.

Perchlorates and the lyotropic series. II. J. DUCLAUX and A. DURAND-GESSELIN (J. Chim. phys., 1938, **35**, 189—192).—Metallic perchlorates affect considerably the solubility of many org. compounds in H_2O. $Mg(ClO_4)_2$ causes increases in the solubilities of $CO(NH_2)_2$, glycine, leucine, glutamic acid, asparagine, $CS(NH_2)_2$, alloxan, succinimide, and allantoin, which were determined, and in those of other compounds which were not determined. The effect seems to be limited to ketones, alcohols, amides, and amines. The effect of 17 metallic perchlorates on the solubility of COMeEt in H_2O was investigated. In every case the solubility was increased, but the effect was due to ClO_4', depending to only a very slight extent on the cation. The specificity of the lyotropic action is not clearly marked in this case where complexes were not formed. $Mg(ClO_4)_2$ gives solid complexes with some of the above compounds. A. J. M.

Adsorption. P. HARTECK (Z. Elektrochem., 1938, **44**, 468—473).—A lecture. Recent investigations are discussed in relation to modern theories. C. R. H.

Interfacial phenomena. P. A. THIESSEN (Z. Elektrochem., 1938, **44**, 458—459).—Introduction to a symposium. C. R. H.

Unimolecular layers. R. BRILL (Z. Elektrochem., 1938, **44**, 459—468).—A lecture. The prep. of unimol. layers and the determination of their state of aggregation are among the subjects considered. C. R. H.

Chemical methods of investigating interfacial relations. R. SCHENCK (Z. Elektrochem., 1938, **44**, 523—524).—Possible methods are discussed. C. R. H.

Investigation of interfacial phenomena by radioactive methods. O. HAHN (Z. Elektrochem.,

1938, **44**, 497—498).—Possible applications of the methods are enumerated. C. R. H.

Fine structure of interfaces. T. SCHOON (Z. Elektrochem., 1938, **44**, 498—507).—Methods of investigating structure, especially the electron diffraction method, are discussed. The application of the latter method to the determination of the variations in lattice consts. in the interface, and to the examination of ZnS, MgO, Al_2O_3, graphite, and fatty acids and their salts, is described. C. R. H.

Movement in interfaces. K. NEUMANN (Z. Elektrochem., 1938, **44**, 474—478).—A lecture. Vol. diffusion, grain boundary migration, and surface diffusion are discussed. C. R. H.

Electron transference in external interfaces. R. SUHRMANN (Z. Elektrochem., 1938, **44**, 478—488). —A general survey. C. R. H.

Energy exchange at interfaces. J. H. DE BOER (Z. Elektrochem., 1938, **44**, 488—497).—A general survey. C. R. H.

Exchange of substances in interfaces. C. WAGNER (Z. Elektrochem., 1938, **44**, 507—512).—A general survey. C. R. H.

Equilibria and reaction velocities in the solid state. K. FISCHBECK (Z. Elektrochem., 1938, **44**, 517).—Theoretical. C. R. H.

Catalysis at interfaces. G. M. SCHWAB (Z. Elektrochem., 1938, **44**, 517—523).—A lecture. C. R. H.

Adsorption of nitrogen and oxygen by tungsten. A. B. VAN CLEAVE (Trans. Faraday Soc., 1938, **34**, 1174—1177).—The adsorption has been studied using the accommodation coeff. of Ne. Rapid adsorption of N_2 at room temp. has been confirmed. Properties of the second O_2 film, which is formed in addition to the well-known stable film, have been investigated. E. S. H.

Adsorption of deuterium on reduced nickel. S. IIJIMA (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 540—546, and Rev. Phys. Chem. Japan, 1938, **12**, 83—89).—Rates of adsorption of D_2 and H_2 on reduced Ni at −45°, −78°, and −121° have been determined. The equation for the adsorption velocity of H_2 and D_2 is the same but the velocity coeff. for D_2 is < that for H_2, as is also the heat of activation. W. R. A.

Primary and secondary adsorption of metal ions on metal surfaces. O. ERBACHER (Z. physikal. Chem., 1938, **182**, 243—255).—The adsorption of $Pb^{\cdot\cdot}$ on Ag and Ni surfaces from solutions in 0·1N- and 12N-HCl has been studied by using Th-*B* as radioactive indicator, comparison being made with measurements of the adsorption of $Ag^{\cdot\cdot}$ on Au surfaces (Euler, A., 1923, ii, 13). The results can be explained on the assumption that the phenomenon comprises primary adsorption of cations, which carry anions with them into the adsorption layer. In 0·1N-HCl the extent of adsorption is independent of temp. and almost independent of the metal of the surface, so long as the concn. of metal ions is sufficient for the adsorption layer to cover > half the surface. At lower cation concn. variations with temp. and surface are observed. Secondary adsorption of Pb is observed in 12N-HCl, where Pb exists almost entirely as $PbCl_4''$ and the metal is adsorbed only in anions accompanying the primarily adsorbed $H^{\cdot}$. J. W. S.

Adsorption of ions on polar adsorbents as a function of the reaction medium. I. Isolated adsorption of some multivalent anions on ferric hydroxide as a function of alkali concentration. G. BĂLĂNESCU and V. T. IONESCU (Bul. Soc. Chim. România, 1937, **19**, 93—131).—Adsorption of solids from solution, non-polar and polar, are discussed and the characteristics of each type indicated. Polar adsorption, which is greatly influenced by the reaction medium, presents the sp. characters of ordinary chemical reactions. The isolated adsorption of AsO_4''', citric, SO_4'', and C_2O_4'' anions on $Fe(OH)_3$, in presence of various amounts of aq. NH_3 and KOH, has been studied by a method which is described. The influence of the medium and of change in the ratio, [Fe‴]/[anion], is indicated. W. R. A.

Direct displacement of equilibrium owing to adsorption of metal ions on platinum. Magnitude of the active spots on inert metals. O. ERBACHER (Z. physikal. Chem., 1938, **182**, 256—264).—In the adsorption of Pb from 12N-HCl solution on a Pt surface the adsorptive force is so great as to displace the equilibrium between $PbCl_4''$ and $Pb^{\cdot\cdot}$ and cause considerable primary adsorption of $Pb^{\cdot\cdot}$, although its equilibrium concn. in such solution is only 10^{-7}. When the Pt is roughened with emery the effect is still further increased and a greater fraction of the surface seems to be covered with active spots, which, it is concluded, are of at. dimensions. J. W. S.

Activation and clarifying properties of fuller's earth. IV. Equilibrium in the ionic exchanges in fuller's earth. B. S. KULKARNI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21A**, 1—7; cf. B., 1938, 682).—The equilibrium const. for the replacement of $H^{\cdot}$ by $Na^{\cdot}$ in fuller's earth has been measured by potentiometric methods in conc. NaCl solutions, and by conductivity methods in dil. solutions. Owing to the limit of exchangeability a certain amount of colour remains in safflower oil treated with the earth. F. R. G.

Some properties of mobile and immobile adsorbed films. J. K. ROBERTS (Proc. Camb. Phil. Soc., 1938, **34**, 399—411).—The adsorption of a diat. gas mol., which dissociates on adsorption to fill two neighbouring vacant places on a solid surface, is investigated. When there is interaction between the adsorbed particles, the rate of formation of the film changes rapidly when θ (fraction of sites occupied) is 0·5—0·6, and for mobile films this is accompanied by a change in the heat of adsorption or evaporation. For an immobile film the behaviour indicates no interaction. The relation of the true to the apparent heat of evaporation for a mobile film, and the kinetics of formation of an immobile film, are discussed. F. J. L.

Statistical theory of adsorption. I. Elementary theory of adsorption in a first and second layer. F. CERNUSCHI (Proc. Camb. Phil. Soc., 1938, **34**, 392—398).—When mols. in the first layer do not

interact with one another, they may give rise to the adsorption of a mol. into the second layer which is bound more tightly than the mols. in the first layer are to the surface of the adsorber; such conditions are shown to give rise to crit. phenomena.

F. J. L.

Films on freshly-abraded copper surfaces. W. E. CAMPBELL and U. B. THOMAS (Nature, 1938, **142**, 253—254; cf. A., 1937, I, 227).—Films of approx. equal thickness, giving similar cathode potential-time curves at const. current, are present on Cu freshly abraded in air or under C_6H_6. The thicknesses of the films, calc. as Cu_2O, are in air 47, under C_6H_6 41, and under H_2O 33 A. Combination of the Cu with O_2 dissolved in the C_6H_6 or in the H_2O at the high local temp. developed explains the results obtained. L. S. T.

Liquid helium II. A. K. KIKOIN and B. G. LASAREW (Nature, 1938, **142**, 289—290; cf. A., 1938, I, 397).—A method for determining the thickness of a film of liquid He II on a surface in contact with it is described. The film is 2—3 $\times$ 10^{-6} cm. thick, and its η is $\gg$ that found by Kapitza (*ibid.*, 131). Heat transfer in the film is high, but may depend on surface evaporation. L. S. T.

Kinetics of adsorption with long-range interaction between adsorbed particles. J. S. WANG (Proc. Camb. Phil. Soc., 1938, **34**, 412—423).—The rates of condensation and evaporation when there is long-range interaction between the adsorbed particles are considered for adsorption (*a*) without dissociation, (*b*) with dissociation. The formulæ in (*a*) are compared with the experimental vals. for the rate of evaporation of Na between 850° and 1250° K., and the variation of the dipole moment with θ (the fraction of sites occupied) is discussed. The formulæ in (*a*) and (*b*) are applied to the diffusion of gases through metals. F. J. L.

Kinetics of wetting and selective linear corrosion of metals in polyphase systems: metal–liquid–liquid and metal–liquid–gas. V. D. I. MIRLIS (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 483—488; cf. A., 1938, I, 87).—With varied texture and activation of the metal surface, the corrosion of Al has been studied by previous methods (A., 1936, 1335) in the equilibrium systems Al-aq. $R{\cdot}CO_2H$–C_6H_6 (R = H, Me, Et, Pr^a), Al-aq. Pr^aCO_2H–air, and Al–H_2O–C_6H_6. Corrosion, varying with R, is most marked at the three-phase boundary though negligible in C_6H_6 solutions of $R{\cdot}CO_2H$. The function of the oxide and acid adsorption films is discussed in relation to comparable results for Fe. Increase in the no. of phases favours selective corrosion.

I. McA.

Ageing of surface of solutions. III. Activated accumulation of dissolved molecules at the surface of benzopurpurin 10B solutions. K. S. G. DOSS (Kolloid-Z., 1938, **84**, 138—143; cf. A., 1936, 1335).—The rate of accumulation of mols. of benzopurpurin 10B at the surface of solutions at room temp. has been measured in relation to concn., p_H, and the presence of dissolved non-electrolytes. The rate increases with concn. and with acidity, and is lowered by capillary-active non-electrolytes (EtOH, $C_5H_{11}{\cdot}OH$). The results support the theory of activated accumulation. F. L. U.

Dependence on temperature of [ionic] exchange in alumina. H. VON WARTENBERG and G. WEHNER (Nachr. Ges. Wiss. Göttingen, Math.-phys. Kl., III, 1936, **1**, 157—159; Chem. Zentr., 1936, ii, 2079).—Exchange of $Cr^{...}$ for $Al^{...}$ in Al_2O_3–Cr_2O_3 mixtures has been studied by observing the rate of colour change at different temp. If k is the velocity coeff. for the exchange, $\log k = -146{,}000/4{\cdot}57T + 15{\cdot}6$. At 1500—1800°, k is doubled by a temp. rise of 30°. Increase of the particle size from 5—10 μ. to 40—60 μ. decreases k to one third of its previous val., the temp. coeff. remaining unchanged. A. J. E. W.

Reactions between silica and calcium oxide in aqueous solutions and their relation to puzzuolanic action. A. E. BEITLICH (J. Amer. Chem. Soc., 1938, **60**, 1832—1836).—Electrical conductivity measurements at 30° show that SiO_2 adsorbs CaO in dil. solutions in accordance with the Freundlich isotherm. When the ratio $CaO/SiO_2 = 0{\cdot}30$—$0{\cdot}60$, chemical combination occurs, and in the reaction product $CaO : SiO_2 = 1 : 2$. This product is stable in solutions containing 1·5 milli-equiv. of CaO per l. When the initial ratio is 0·60—0·90, adsorption occurs again and the product has $CaO : SiO_2$ 4 : 5. This product is stable in solutions containing up to 10 m.-equiv. of CaO per l. A third range of adsorption reactions takes place when the initial ratio is 1·3—3·75 and the CaO/SiO_2 ratio in the product approaches 2 : 1, indicating the probable existence of $2CaO,SiO_2$ in saturated aq. CaO. E. S. H.

Dependence of stabilisation and wetting of particles suspended in oil medium on the quantity of surface-active substance adsorbed. P. CHOMIKOVSKI and P. REHBINDER (Compt. rend. Acad. Sci. U.R.S.S., 1938, **18**, 575—578).—The effects of oleic acid on suspensions of pigment particles in PhMe have been investigated. The max. of stabilisation coincides with the min. of wetting by water and with saturation of the surface by adsorbed oleic acid.

F. J. G.

Surface films of gliadin. G. I. JENKINS and T. W. J. TAYLOR (Nature, 1938, **142**, 291—292).—Data for the spreading of dil. solutions of gliadin in 70% alcohol on 0·01N-H_2SO_4 or -HCl substrates for a time interval from 3—1065 min. show no evidence of a transition point such as that reported by Mitchell (A., 1937, I, 511) at 1—2 dynes per cm. Equilibrium is reached in 5 min. For a time interval of 5—70 min. the extrapolated ρ of the film is fairly const. at 1·22 $\times$ 10^{-7} g. per sq. cm. The fall in ρ with time is due not to slow spreading but to accidental contamination of the film. L. S. T.

Hygroscopicity and hysteresis of mercerised cellulose. F. I. BOGOIAVLENSKI (Utschen. Zap. Univ. Kazan, 1938, **97**, 83—93).—Mercerised cotton wool absorbs H_2O vapour more readily than untreated cotton wool; its hygroscopicity rises with the alkali concn. and reaches a limit at 4N-NaOH and 6N-KOH, where it is 1·6—1·7 times that for untreated cotton wool. At the same concn. the hysteresis shows a max.

J. J. B.

Heats of adsorption of alkalis by standard cellulose. J. L. MORRISON, W. B. CAMPBELL, and O. MAASS (Canad. J. Res., 1938, **B**, **16**, 195—202).—Heats of adsorption have been measured for aq. solutions of LiOH, NaOH, KOH, NaCl, and K_2CO_3 and for a solution containing NaCl and NaOH. The results suggest that the adsorption of alkali depends on the availability of H^+ from the cellulose which, in the presence of a strong base, acts as a weak acid. The OH^- ion of the base neutralises the H^+ ion and the alkali cation attaches itself to the O of the cellulose very much as in salt formation. The cellulosate is very readily hydrolysed. The heats of adsorption agree with this hypothesis. A. J. M.

Measurement of diffusion coefficients in liquid systems. S. PLEŚNIEWICZ (Congr. int. Quim. pura apl., 1934, **9**, II, 237—248; Chem. Zentr., 1936, ii, 2317; cf. A., 1936, 1071).—Data for aq. $CdCl_2$, $K_2Cr_2O_7$, $K_3Fe(CN)_6$, and $K_4Fe(CN)_6$ are recorded. A. J. E. W.

Diffusion of non-electrolytes in organic liquids. O. LAMM (Trans. Faraday Soc., 1938, **34**, 1152—1158).—A crit. discussion of published work. E. S. H.

Diffusion of water in glycerol. O. LAMM and G. SJÖSTEDT (Trans. Faraday Soc., 1938, **34**, 1158—1163).—The rate of diffusion, measured by a refractometric method, is abnormally high, indicating that the H_2O mols. are not bound to glycerol mols., and that the diffusibility of H_2O is not determined simply by the η of glycerol. E. S. H.

Diffusion of electrolyte solutions. K. SITTE and V. DANIEL (Z. physikal. Chem., 1938, **182**, 295—318).—The diffusion of electrolytes is treated theoretically, and it is inferred that in the limiting case of very dil. solutions it should follow a law $D = D_0(1 + A\sqrt{c})$, where D and D_0 are the diffusion coeffs. at concn. c and at infinite dilution, respectively, and A is a const. The diffusion of LiCl, LiBr, NaCl, NaBr, NaI, KCl, KBr, and KI in aq. solution has been measured by Zuber's micro-method. At very low concn. the ideal law holds, but even at 0·05M the diffusion const. is > the theoretical val., and the divergences increase with concn. This behaviour is attributed to ionic association and reciprocal action with the H_2O dipoles. The diffusion coeffs. of LiCl in MeOH and EtOH and of NaI in EtOH are ≫ the vals. predicted theoretically. The movement of ions in these solvents can be explained on the basis of interionic force and of forces between particles and dipoles of the solvent. It is unnecessary to assume sp. forces in H_2O or in the alcohols. J. W. S.

Osmosis. E. ERNST and J. KOCZKÁS (Z. Physik, 1938, **109**, 625—641).—It is shown theoretically and experimentally that osmosis is not explainable in terms of the kinetics of the solute, but by the relations between the v.p. of the solvent on opposite sides of the membrane, such that when solutions of the same concn. and different temp. are separated by a membrane, solvent flows from the solution at the highest temp. L. G. G.

Partial molal volumes of lithium chloride and of sodium nitrate in liquid monomethylamine. E. A. KELSO [with W. A. FELSING] (J. Amer. Chem. Soc., 1938, **60**, 1949—1951).—The d of the solutions have been determined at 0—25° and recorded as functions of concn.; the apparent and partial mol. vols. have been calc. In LiCl solutions the apparent mol. vol. decreases as the dielectric const. of the solvent decreases in the order H_2O, MeOH, EtOH, NH_2Me. E. S. H.

Densities, viscosities, and conductivities of alcoholic solutions of magnesium chloride. F. OLMER (Bull. Soc. chim., 1938, [v], **5**, 1178—1184).—Data for seven alcohols at 17° are graphically presented. The hexahydrate is more sol. than the anhyd. salt in primary alcohols. C. R. H.

Viscosity and density of aqueous solutions of weak electrolytes at 35°. M. K. SRINIVASAN and B. PRASAD (Trans. Faraday Soc., 1938, **34**, 1139—1141).—For weak electrolytes the Jones and Dole equation assumes the form $\eta/\eta_0 = 1 + A\sqrt{(\alpha c)} + \beta(1 - \alpha)c$, where A has the customary meaning. Vals. determined for A are: AcOH 0·020, salicylic acid 0·03, succinic acid 0·02, BzOH 0·00. The calc. val. for AcOH is 0·0031, and those for the other acids should be of the same order. In each case d varies linearly with concn. for dil. solutions. E. S. H.

Optical properties of turbid liquids observed by reflexion; influence of dilution. L. AMY (Compt. rend., 1938, **207**, 329—331).—The colour of typical suspensions is found to be independent of the dilution. A. J. E. W.

Aqueous solutions of acids of high mol. wt. and their salts. W. KERN (Angew. Chem., 1938, **51**, 566—569).—Although the conductivity of such solutions does not depend on the degree of polymerisation of the anion, acids of high mol. wt. act as cation buffers in osmotic pressure measurements. The expression for the dissociation of such polybasic acids resembles the Michaelis equation for monobasic acids. K. W. P.

Highly-polymerised compounds. CXCVIII. Dependence on temperature of osmotic pressure, heat of dilution, and entropy of dilution of high-molecular solutions. G. V. SCHULZ (Z. physikal. Chem., 1938, **B**, **40**, 319—325).—Equations are derived and successfully applied to earlier data (cf. A., 1937, I, 563). C. R. H.

Conductivity anomalies (field and frequency effects) in molecularly and colloidally disperse solutions. K. HOFFMANN (Kolloid-Z., 1938, **84**, 344—357).—A review.

Gas colloids. R. HAUL (Chem.-Ztg., 1938, **62**, 581—584).—A general discussion of aërosols. F. L. U.

Pure silver iodide sols. H. DE BRUYN and J. T. G. OVERBEEK (Kolloid-Z., 1938, **84**, 186—191).—AgI sols, after prolonged purification by electrodialysis and electrodecantation, show departures from the behaviour of strong acids when submitted to electrometric titration. The observed deviations have been traced to the presence of $Zn^{\cdot\cdot}$ and $Cu^{\cdot\cdot}$ in the wash H_2O. The use of doubly distilled H_2O affords sols in which >98% of the "gegenions" consist of $H^{\cdot}$. F. L. U.

Magnetic birefringence of colloidal solutions of iron oxide. J. Errera, W. Oostveen, and H. Sack (Rec. trav. chim., 1938, **57**, 850).—An error in a previous paper (A., 1938, I, 194) is corr. F. L. U.

Stability of colloidal solutions. J. Duclaux (J. Chim. phys., 1938, **35**, 185—188).—The stability of a colloidal solution, defined as the osmotic work required to separate the micelles and the intermicellar liquid, varies considerably from one colloidal solution to another. It is greater for dil. solutions than for more conc. ones, and varies, within a certain limit, with log concn. The stability is also governed by the mol. wt. of the colloid and its degree of ionisation. There is no direct relationship between the electrokinetic potential or the hydration and the stability of the colloidal solution, although these are indirectly connected with it. A. J. M.

Dispersion of solids in liquids by ultrasonic waves. K. Söllner (Trans. Faraday Soc., 1938, **34**, 1170—1174).—Solids of low cohesion (*e.g.*, mica, gypsum, graphite, S) are dispersed in liquids by the action of ultrasonic waves. The dispersions contain particles of colloidal size; the dispersed particles are further disintegrated when irradiated with ultrasonic waves of high energy. E. S. H.

Thixotropy. C. W. Korrens and H. G. F. Winkler (Naturwiss., 1938, **26**, 517).—Colloidal particles which are flat or rod-shaped (kaolin, halloysite, metahalloysite, muscovite, glauconite, graphite, Mo glance, tremolite) show thixotropy in H_2O. Approx. isometric sols. *e.g.*, powdered quartz, felspar, and fluorspar, do not show thixotropy. The thixotropy is the greater the smaller is the size of the particle, and for small particle size the relationship is linear. Electrolytes are unnecessary. Their effect varies and does not follow the coagulation series. Thixotropy also occurs in all org. liquids investigated, and may be greater here than in H_2O. It is possible to make quartz, felspar, and fluorspar particles of diameter 1—6 μ. show thixotropy in C_6H_6. It is inferred that all substances will show the phenomenon in a suitable liquid if the particle size is small enough. A. J. M.

Electrochemistry of Congo dye sols. W. Pauli and P. Szarvas (Kolloid-Z., 1938, **84**, 179—186).—In Congo-blue sols (obtained by electrodialysis of Congo-red) the H-ion activity calc. from conductivity measurements is < that determined potentiometrically, and the inequality persists at the highest dilution used (3×10^{-5}M). Potentiometric titration with NaOH indicates, in the region p_H 10—12, additional alkali fixation up to a limit of 4 NaOH : 1 mol. dye. These results are interpreted in relation to tho chemical constitution of the dye. F. L. U.

Lyotropic series in swelling. XIII. Effect of salts of alkylamines.—See A., 1938, III, 842.

Influence of colloids on cathodic polarisation. Electrodeposition of silver in presence of Paal's mixture. G. S. Vozdvishenski (Utschen. Zap. Univ. Kazan, 1937, **97**, No. 8, 51—54; cf. B., 1937, 146).—Paal's mixture increases the cathodic polarisation of Ag in $AgNO_3$ solutions. J. J. B.

Structural viscosity and properties of cellulose esters. IV. Change in viscosity of concentrated solutions of cellulose nitrates. Z. Rogovin and S. Glazman (J. Gen. Chem. Russ., 1938, **8**, 498—506; cf. B., 1938, 357).—The η of 12% solutions of cellulose nitrate (I) in a series of solvents falls with time to an extent which diminishes in the series $COMe_2$>EtOH–Et_2O>MeOH>EtOAc. The effect is not due to elimination of HNO_3, but appears to be associated with change in the shape of the (I) mols. R. T.

Variations in viscosity of cellulose nitrate sols. III. Cellulose nitrate of lowered viscosity. A. A. Morozov, A. V. Pamfilov, and A. G. Schicher (J. Gen. Chem. Russ., 1938, **8**, 572—577; cf. A., 1938, I, 311).—The gradual fall in η of sols of cellulose acetate or nitrate in various solvents is ascribed to the slowness of the dissolution process. R. T.

Optical properties of cellulose dispersed in cuprammonium hydroxide solution. J. Compton (J. Amer. Chem. Soc., 1938, **60**, 1807—1812).—[α] for cellulose-cuprammonium hydroxide dispersions (*A*) is unchanged by pre-treatment of the cellulose with HCl, NaOCl, or H_2O_2; the reduction in η caused thereby is due to destruction of the "cementing" material and not to any effect on the crystallites. (*A*) are not true solutions, for the no. of crystallites present may be counted under high magnification using the slit ultramicroscope; this no. is that theoretically expected for crystallites $1{\cdot}1 \times 1{\cdot}5$ μ. The crystallites have all the properties of Hess' micelles, excepting the shape and size. Evidence is adduced to show that cellulose–Cu complex formation precedes dispersion in cuprammonium hydroxide solution. [α] vals. for cellodextrin–cuprammonium hydroxide dispersions are < those for (*A*); the cellodextrin particles therein are too small to be made visible by the ultramicroscope. R. S. C.

Lyophilic properties of cellulose and its derivatives. XVI. Absorption of the vapours of various liquids. K. Kanamaru and J. Chao (J. Soc. Chem. Ind. Japan, 1938, **41**, 171—182B).—Determinations have been made of the absorption isotherms at 30° of the vapours of H_2O, MeOH, EtOH, $Pr^{\alpha}OH$, $Bu^{\alpha}OH$, Et_2O, $COMe_2$, C_6H_6, AcOH, and $CHCl_3$ on cellulose (I) in various forms, including regenerated (I), and on (I) acetates and nitrates of various degrees of esterification and in various mechanical forms. Comparisons are made of the absorptions at 20 and 90% relative v.p. Regenerated (I) has a higher hygroscopicity than ordinary (I), but absorbs smaller amounts of org. liquids, particularly at low v.p. At a low v.p. the absorption of an org. vapour by a material in film form is generally lower than that by the same material in the fibrous condition, but this tendency is reversed at a high v.p. There is no simple relation between the solubility of a (I) ester in an org. liquid and the absorption of the corresponding vapour. Calculations are made for each system of two quantities stated to be ∝ ζ-potential (A., 1938, I, 396, 456). Comparison of these quantities with the mol. % absorptions supports the view that the lyophilic properties of (I) and its derivatives depend on the ζ-potential. W. A. R.

Mechanism of action of neutral salts on collagen. S. A. PAVLOV (J. Gen. Chem. Russ., 1938, 8, 456—459).—The peptising action on collagen of bivalent is > that of univalent cations. The NH_2-N of the solutions as determined by Van Slyke's method differs considerably from that derived from Sørensen titration of CO_2H groups. The action of neutral salts is supposed to consist in the removal of polypeptide fragments, and possibly in their cyclisation. R. T.

Charge-reversing concentrations of alkali and alkaline-earth chlorides for tri- and hexa-hydroxystearate at varying p_H. P. H. TEUNISSEN, S. ROSENTHAL, and W. H. ZAAIJER (Rev. trav. chim., 1938, 57, 929—940).—Electrophoretic measurements with SiO_2 particles coated with tri- (I) or hexa- (II) -hydroxystearate in presence of alkali or alkaline-earth ions show a tendency for the order of the lyotropic series to be reversed with increasing OH content of the acid, the tendency being weak at p_H 10 and pronounced at p_H 6. In this respect (I) and (II) form a transition between oleic and arabic acids; thus in an acid medium the order is for oleate Mg < Ca < Sr < Ba, for (I) Ca < Mg < Sr < Ba, for (II) Ba < Ca < Sr < Mg, and for arabate Ba < Sr < Ca < Mg. It is inferred that the polarisability of the CO_2H is diminished by introduction of OH. F. L. U.

Physical chemistry of amino-acids, peptides, and related substances. XI. Solubility of cystine in presence of ions and another dipolar ion. E. V. COHN, T. L. MCMEEKIN, and M. M. BLANCHARD (J. Gen. Physiol., 1938, 21, 651—663).—Both glycine (I) and neutral salts increase the solubility of cystine (II) at all concns. The interaction between (II) and ions is diminished by (I); increase in ionic strength diminishes the interaction of (I) and (II). Na_2SO_4 increases the solubility of (II), but above 1 mol. per l. it has a salting-out effect, enhanced by (I). These interactions are analysed mathematically and discussed in detail. A. E. W.

Adsorption of proteins of oil–water interfaces and artificial proteins–lipin membranes. I. LANGMUIR and D. F. WAUGH (J. Gen. Physiol., 1938, 21, 745—755).—Experiments of Devaux (A., 1935, 819, 1071) on the formation of insol. protein fibres at air–H_2O and oil–H_2O interfaces are repeated and confirmed. Attempts were made, with some success, to build up pure protein membranes on Pt-wire loops passed through a protein film adsorbed at an oil–H_2O interface. The most durable membranes were obtained when the protein films were pre-stretched, and when lecithin was present. A mixture of C_6H_6 and CCl_4 in H_2O forms a stable suspension when it is shaken with a few drops of 1% albumin solution. The large drops of hydrocarbon are almost motionless in the aq. phase, and are not uniformly spherical (*i.e.*, the surface tension is zero). In many instances a droplet of H_2O is seen inside the hydrocarbon drops. It is suggested that perfusion of such double drops with H_2O would dissolve out the hydrocarbons, leaving a double shell of protein rather like a cell wall. Further biological applications of these experiments are suggested. A. E. W.

Electrokinetic phenomena. XIII. Comparison of isoelectric points of dissolved and crystalline amino-acids. H. A. ABRAMSON and L. S. MOYER (J. Gen. Physiol, 1938, 21, 729—744).—The isoelectric points of the surfaces of cryst. tyrosine (I), cystine (II), and aspartic acid all lie near p_H 2·3, although the isoelectric points of the dissolved substances differ widely. Crystals of (I) and (II) adsorb gelatin (III), the surface attained being identical with (III)-coated quartz or collodion particles. Al ions reduce the electric mobility of (I) crystals to zero in a manner analogous to their effect on other surfaces. The relations of these results to the concept and general definition of the isoelectric points is discussed. A. E. W.

Application of cryolysis to humus complexes. C. ANTONIANI (Naturwiss., 1938, 26, 479).—Changes occurring in the degree of dispersion of colloidal humus complexes on freezing have been investigated by determining the velocity of electrophoretic migration before and after freezing. Freezing causes an increase in the velocity of migration and hence increases the dispersion of the colloidal particles. A. J. M.

Vapour retention capacity of active gels. F. KRCZIL, F. SCHÄTZLER, and E. BRIXEL (Kolloid-Z., 1938, 84, 144—149).—The amount of C_6H_6 vapour retained by active SiO_2 and Al_2O_3 gels after passage of a stream of air is ultimately independent of the initial vapour-charge. As with active C (A., 1934, 358) differences are observed only in the early stages of desorption. F. L. U.

Quantitative study of rhythmic precipitation. K. NEUMANN and V. COSTEANU (Kolloid-Z., 1938, 84, 130—138).—The time of formation and linear separation of the rings formed by $AgNO_3$ diffusing into capillary tubes containing K_2CrO_4–gelatin have been measured for different concns. of the reactants and at different temp. The results are in harmony with the supersaturation theory. The empirical relation between time, separation, and ordinal no. of the rings found by Lakhani and Mathur (A., 1934, 488) is derived theoretically. F. L. U.

Interference patterns with Liesegang rings. (SIR) C. V. RAMAN and K. SUBBARAMIAH (Nature, 1938, 142, 355).—Liesegang rings of AgCl or Ag_2CrO_4 in gelatin show an interference pattern with characteristic discontinuity of phase on either side of a line of zero disturbance. L. S. T.

(A) Silver chromate banding in silicic acid gel. (B) Calcium phosphate banding in silicic acid gel. T. ISEMURA (Bull. Chem. Soc. Japan, 1938, 13, 489—493, 493—504).—(A) Rhythmic ppts. are formed by adding $AgNO_3$ to Na_2SiO_3 and $K_2Cr_2O_7$ in presence of 0·6—0·7N-HNO_3 (cf. Hatschek, A., 1926, 349). At lower acid concn. there is no banding, and gelatinisation does not occur at higher concn. Other acids may be used.

(B) Two methods are described for preparing rhythmic ppts. from $Ca(NO_3)_2$, Na_2HPO_4, 0·75N-AcOH, and Na_2SiO_3. The bands are not obtained with higher or lower acid concn. but either $Ca(NO_3)_2$ or Na_2HPO_4 may be used as inner electrolyte. The

varying appearance of the bands with varying concn. of inner electrolyte and gel, and with addition of sucrose, glucose, $CO(NH_2)_2$, KBr, and NaCl, are recorded. Ageing of the gel produces no effect. F. R. G.

Colloid-chemical investigation of Chistopol floridin clays. G. S. Vozdvishenski and A. F. Gerasimov (Utschen. Zap. Univ. Kazan, 1937, **97**, No. 8, 33—50).—The rate of sedimentation is measured and the particle sizes are calc. The rate is strongly increased by dialysis. It is increased by salts according to the series $HCl > H_2SO_4 > K_2SO_4 > KCl > KH_2PO_4 > NaCl > Na_2SO_4 > Li_2SO_4$, is little affected by gelatin and agar, and decreased by NH_3, LiOH, NaOH, and KOH. J. J. B.

Micellar structure of hydrous cellulose gels. P. H. Hermans (Kolloid-Z., 1938, **84**, 168; cf. A., 1938, I, 79).—An acknowledgment of a paper by Gerngross and others (A., 1932, 1088). F. L. U.

Micellar structure and deformation processes in fibrous materials. V. Theory of structural network. O. Kratky (Kolloid-Z., 1938, **84**, 149—168; cf. A., 1937, 1, 515).—The behaviour of a fibrous network during swelling and mechanical deformation is discussed theoretically. F. L. U.

Space model of viscosity function of disperse systems. F. Frimberger and J. Rehme (Kolloid-Z., 1938, **84**, 196—199).—Three-dimensional models showing the relations between total η, η of the dispersion medium, and vol. of disperse phase are described. Their use is illustrated by reference to suspensions of red blood corpuscles in gum arabic solutions. F. L. U.

Structure mechanics of viscous-elastic continua. II. Wave-mechanical theorem of turbulence. H. Umstätter (Kolloid-Z., 1938, **84**, 168—179; cf. A., 1936, 795).—Mathematical. F. L. U.

Dissociation coefficient of hypobromous acid. E. A. Schilov and J. N. Gladtschikova (J. Gen. Chem. Russ., 1938, **8**, 448—451).—K is $2{\cdot}06 \times 10^{-9}$, at 20°. R. T.

Dissociation constants of deutero-acids by e.m.f. measurements. C. K. Rule and V. K. La Mer (J. Amer. Chem. Soc., 1938, **60**, 1974—1981).—The cells investigated by Korman and La Mer (A., 1936, 1202) have been re-examined. The ratio of dissociation consts. in H_2O and D_2O has been determined for BzOH, H_2PO_4', and quinol and compared with published data for AcOH and $CH_2Cl{\cdot}CO_2H$. The ratio decreases as the strength of the acid increases and may become unity for acids as strong as H_3O^+. E. S. H.

Acid dissociation constants in dioxan–water mixtures. Correction of dissociation constant of benzoic acid. C. C. Lynch and V. K. La Mer (J. Amer. Chem. Soc., 1938, **60**, 2000).—A correction (cf. A., 1938, I, 358). E. S. H.

Electrometric and ultra-violet spectrographic investigation of some α-ketonic ene-diols. G. E. Carpéni (J. Chim. phys., 1938, **35**, 193—211; cf. A., 1938, I, 399; II, 347).—The dissociation consts. and the ultra-violet absorption spectra of *l*-ascorbic, *d*-arabo-ascorbic, *d*-gluco-ascorbic acids, reductone, reductinic, croconic, and rhodizonic acids have been determined. The first dissociation consts. of the products obtained by oxidising the first six of these with I have also been obtained. The order of magnitude of the second dissociation consts. was obtained from a study of the ultra-violet absorption of their solutions. The characteristic absorption bands for the ene-diols vary with p_H, the effect being due to variation in the absorption due to the undissociated mols., the univalent ions, and the bivalent ions. A. J. M.

Electrolytic dissociation of cadmium iodide. Y. Doucet (Compt. rend., 1938, **207**, 362—364).—Results of cryoscopic measurements for solutions of CdI_2 in $CaCl_2{,}6H_2O$ are recorded. The vals. of f are confirmed by e.m.f. measurements. The data suggest the presence of two ions for $c = 0{\cdot}12$—$0{\cdot}30$ mol. per l., and up to six ions for more dil. solutions; a similar result is obtained with solutions of CdI_2 in KNO_3–H_2O eutectic. The results suggest the existence of $Cd[CdI_4]$ in conc. solutions, the complex CdI_4'' dissociating at high dilutions. A. J. E. W.

Activity coefficient of cobalt chloride in aqueous solution at 25°. R. A. Robinson (Trans. Faraday Soc., 1938, **34**, 1142—1143).—Data determined by the isopiestic v.p. method for 0·05—2M. solutions are recorded. The results appear to indicate complete dissociation. E. S. H.

Application of the Raman effect to the study of complexes existing in solutions containing mercuric iodide and an alkali iodide. (Mlle.) M. L. Delwaulle, F. François, and J. Wiemann (Compt. rend., 1938, **207**, 340—342).—Raman νν attributed to HgI_4'' and HgI_3' are exhibited by solutions containing both HgI_2 and LiI in H_2O, alcohols, and $COMe_2$. The HgI_3' ν is also shown by cryst. KI,HgI_2,H_2O, suggesting that this ion may also contain a solvent mol. HgI_4'' probably has a tetrahedral structure. A. J. E. W.

Polyiodides and polyiodide ions. Cæsium polyiodides. G. Venturello (Gazzetta, 1938, **68**, 394—404).—Vals. of d and of η at 25° for solutions of $CsI + I_2$ in aq. alcohol (57·9 vol.-% EtOH) are recorded. These indicate the presence of I_3', I_5', and I_7' ions, but not of I_4' or I_9'. The viscosity of CsI solutions in the above solvent decreases with increasing concn. O. J. W.

Equilibria in chromic acid and dichromate solutions. E. Endrédy (Math. nat. Anz. ung. Akad. Wiss., 1936, **54**, 459—493; Chem. Zentr., 1936, ii, 1684).—In aq. solutions of CrO_3 and $K_2Cr_2O_7$ an equilibrium between Cr_2O_7'' and $HCrO_4'$ ions is established, the const. for which varies only slightly with the temp. The concn.-dependence of the conductivity, of the mol. vol., and of the absorption spectrum is explained in terms of this equilibrium. The vals. of the ionic mobility of $HCrO_4'$ and Cr_2O_7'' at 20° are 49·5 and 62—63, respectively. H. J. E.

Constitution of double-shelled complex compounds. Á. von Kiss and D. von Czeglédy (Z. anorg. Chem., 1938, **239**, 27—38).—Extinction curves

from 200 to 700 mμ. for the $[Co(NH_3)_6]^{'''}$, $[Co(NH_3)_5Cl]^{''}$, $[Co(NH_3)_5H_2O]^{'''}$, $[Co(NH_3)_4(H_2O)_2]^{'''}$, and $[Co(NH_3)_4CO_3]^{'}$ ions in 4N-$(NH_4)_2SO_4$, 3N-K_2HPO_4, 3N-$K_2C_2O_4$, 4N-NaCl, and 3N-$Na_2S_2O_3$ have been determined and compared with those in H_2O. The curves resemble those in H_2O for all five complex ions in $(NH_4)_2SO_4$, for the $[Co(NH_3)_6]^{'''}$ and $[Co(NH_3)_4CO_3]^{'}$ ions in NaCl and K_2HPO_4, and for the $[Co(NH_3)_4CO_3]^{'}$ ion in $K_2C_2O_4$. In other instances more or less pronounced changes are found. The bearing of these results on the nature of the complex ion in solution is discussed. Where the curves are unchanged a heteropolar double-shelled complex anion is formed. In the other instances the changes are not attributed to a homopolar character of the double-shelled complex, but to changes in the cobaltammine unit, such as the replacement of chloro- or aquo-groups by hydroxo- or oxalato-groups, followed by formation of a heteropolar double-shelled complex involving the new cobaltammine unit. F. J. G.

Water as an admixture in liquid sulphur dioxide. K. Wickert (Z. anorg. Chem., 1938, **239**, 89—94).—The equilibrium between liquid SO_2 and H_2O, and the behaviour of solutions of H_2O in liquid SO_2, have been investigated. At 22° the liquid layers contain 2·3 g. of H_2O per 100 g. of SO_2, and 49·1 g. of SO_2 per 100 g. of H_2O, respectively. On evaporation at 0° of liquid SO_2 saturated with H_2O crystals remain of the *compound* SO_2,H_2O, which decomposes at 12°. Anhyd. SO_2 has $\chi = 0{\cdot}1 \times 10^{-6}\ \omega^{-1}$ independently of temp. from −20° to 30°; solutions of H_2O in SO_2 have a greater χ which increases with rising temp. When the solutions are electrolysed, gas is evolved at the anode and S is deposited at the cathode. These results are interpreted by regarding SO_2,H_2O as thionyl hydroxide, $SO(OH)_2$, ionising to $SO^{''} + 2OH'$, which are discharged on electrolysis as follows: $2SO^{''} + 2\ominus = SO_2 + S$; $2OH' + 2\oplus = H_2O + \frac{1}{2}O_2$. When a sealed tube containing SO_2, KBr, and H_2O is left for some weeks $KHSO_3$ is pptd. in accordance with: $SO(OH)_2 + 2KBr = SOBr_2 + 2KOH$ and $KOH + SO_2 = KHSO_3$. F. J. G.

Volatility of boric acid in presence of various salts. Borophosphates and boroarsenates. V. G. R. Levi and R. Curti (Gazzetta, 1938, **68**, 376—380; cf. A., 1938, I, 354).—The volatility of H_3BO_3 from aq. solution at the b.p. is increased by those salts which diminish the solubility, and vice versa. Substances which can form complexes with H_3BO_3 lower its volatility. In presence of Na salts of H_3PO_4 and of H_3AsO_4 it is found that borophosphoric and boroarsinic acids can be detected in sufficiently conc. solutions even at the b.p. O. J. W.

Selenious acid. F. Ishikawa and H. Abe (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 775—786; cf. A., 1913, ii, 948; 1922, ii, 283).—Tensimetric measurements show that the dissociation pressure (mm.) of H_2SeO_3 can be expressed below 70° by $\log p = -3516{\cdot}94/T + 11{\cdot}9024$ and above 70° by $\log p = -188615/T + 7{\cdot}1520$. Above 71°, H_2SeO_3 is unstable with respect to SeO_2; this is indicated by a break in the $\log p$–$1/T$ plot, and supported by analysis of the solid phase produced when H_2SeO_3 is heated with a small quantity of H_2O for 48 hr. at 80°. Measurements of the solubility of H_2SeO_3, and of the v.p. of its saturated solutions, have been made; the results are considered to be more accurate than those in the literature since great care was taken to ensure equilibrium conditions. R. C. M.

Properties of osmium tetroxide in carbon tetrachloride solutions. Thermodynamic constants of osmium tetroxide. L. H. Anderson and D. M. Yost (J. Amer. Chem. Soc., 1938, **60**, 1822—1825).—The distribution ratios of OsO_4 between CCl_4 and H_2O at 25° have been determined at different concns. up to the saturated solutions. V.p. of CCl_4 over solutions containing OsO_4 have been determined at 25°; the results are not in accordance with Raoult's equation. The free energies of formation of solid, gaseous, and aq. OsO_4, calc. from electron-diffraction, spectroscopic, and thermal data, are: −70,900, −28,000, and −68,788 g.-cal. E. S. H.

Transition temperature of magnesium bromide. F. H. Getman (Rec. trav. chim., 1938, **57**, 847—849).—The transition temp. corresponding with $MgBr_2,10H_2O \rightleftharpoons MgBr_2,6H_2O + 4H_2O$, determined thermometrically, is 10·84°. The temp. previously deduced (A., 1936, 30) from solubility data is incorrect. F. L. U.

System Cr–P. H. Nowotny and E. Henglein (Z. anorg. Chem., 1938, **239**, 14—16).—The system has been analysed by the *X*-ray method from 0 to 50 at.-% P. In addition to CrP (cf. A., 1987, ii, 265; 1931, 809) there is a *compound* Cr_3P. It is a light grey powder, very faintly ferromagnetic, and isomorphous with Fe_3P, *i.e.*, space-group S_4^3, with 8 mols. in the unit cell and *a* 9·126, *c* 4·560 A. CrP is dark grey, non-ferromagnetic, and isomorphous with MnP, having space-group D_{2h}^{16} with 4 mols. in the unit cell and *a* 5·93, *b* 5·35, *c* 3·12 A. F. J. G.

***X*-Ray investigation of the system Co–S.** D. Lundqvist and A. Westgren (Z. anorg. Chem., 1938, **239**, 85—88).—The only compound phases in the temp. interval 500—650° are Co_9S_8, CoS, Co_3S_4, and CoS_2. Co_9S_8 has *a* 9·907 A., whether formed in presence of excess of Co or of CoS, and irrespective of its thermal history. CoS when tempered at 650° has *a* 3·367, *c* 5·177 A. if saturated with Co, and *a* 3·361, *c* 5·160 A. when saturated with S, the homogeneous region extending from 51 to 53 at.-% S. On prolonged tempering at 200° it changes over from the NiAs structure to a complicated structure which has not been analysed. The existence of Co_3S_4 (cf. A., 1927, 502; 1935, 1335) is confirmed; it is face-centred cubic with *a* 9·382 A., space-group O_h^7, 8 mols. in the unit cell. The structure found for CoS_2 agrees with that given by de Jong and Willems (A., 1927, 328) but the val. found for *a* is 5·524 A. instead of 5·64 A. F. J. G.

Carbide studies by the methane method. II. [System Mn–C.] R. Schenck and K. Meyer (Z. anorg. Chem., 1938, **239**, 161—179).—The system Mn–C has been investigated by measurements of the CH_4–H_2 equilibrium over it at 700—970°. Mn_3C exists as a stable phase above 750°, and forms solid solutions with its constituents. Below 750° Mn_4C

appears as a metastable phase. An equilibrium diagram is given. F. J. G.

Cyanic acid. III. Melting system cyanic acid-water. M. LINHARD (Z. anorg. Chem., 1938, 239, 155—160; cf. A., 1938, II, 352).—HCNO and H_2O form a simple eutectiferous system; HCNO melts at −86·8°, and the cryohydric point corresponds with −102° and 67 mol.-% of HCNO. There are no indications of the formation of hydrates or of $NH_2{\cdot}CO_2H$. F. J. G.

System KCl-$KHCO_3$-H_2O between 10° and 40°. R. PARIS and P. MONDAIN-MONVAL (Bull. Soc. chim., 1938, [v], **5**, 1142—1147).—Data obtained at four temp. are recorded. Only KCl and $KHCO_3$ are present as solid phases. C. R. H.

Equilibrium and formation of complexes in the system H_2O-NH_4NO_3-$(NH_4)_2SO_4$. V. A. SOKOLOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 123—135).—Solubility data have been obtained from 70° to −22·4°. The existence of $(NH_4)_2SO_4,3NH_4NO_3$, $(NH_4)_2SO_4,2NH_4NO_3$, and $(NH_4)_2SO_4,NH_4NO_3$ is confirmed by thermal and *X*-ray analysis. The regions of stability of the double salts have been determined. E. S. H.

Solubility curves of secondary and tertiary potassium orthophosphate in water. M. I. RAVITSCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 137—146).—The data show that the stable phases are: $K_2HPO_4,6H_2O$ (−13·5° to 14·3°), $K_2HPO_4,3H_2O$ (14·3—48° approx.), K_2HPO_4 (> 48°), $K_3PO_4,9H_2O$ (−24° to −15°), $K_3PO_4,7H_2O$ (−15° to 45·4°), $K_3PO_4,3H_2O$ (>45·4°). E. S. H.

Crystallographic study of solid phases of the system K_2O-P_2O_5-H_2O. G. B. BOKI and E. E. BUROVAJA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 185—194).—Crystallographic data are recorded for $K_3PO_4,3H_2O$, $K_3PO_4,7H_2O$, $K_3PO_4,9H_2O$, K_2HPO_4, $K_2HPO_4,3H_2O$, $K_2HPO_4,6H_2O$, K_2HPO_4, and $KH_5(PO_4)_2$. E. S. H.

Solid solutions in the system KH_2PO_4-$NH_4H_2PO_4$-H_2O. A. J. ZVORIKIN and V. G. KUZNETZOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 195—201).—Solubility data for 0°, 25°, and 50° are recorded. Well-formed mixed crystals are obtainable when either salt is present in considerable excess. *X*-Ray investigation shows that solid solutions are formed within the ranges 0—41·65% KH_2PO_4 and 0—33·48% $NH_4H_2PO_4$. The lattice consts. for KH_2PO_4 increase as the proportion of $NH_4H_2PO_4$ in solid solution increases. E. S. H.

Solubility isotherm of the ternary system K_2O-P_2O_5-H_2O at 50°. L. G. BERG (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 161—166).—The isotherm consists of ten curves, corresponding with the solid phases: KOH,H_2O, $KOH,2H_2O$, $K_3PO_4,3H_2O$, $K_3PO_4,7H_2O$, K_2HPO_4, $K_2HPO_4,3H_2O$, $K_2HPO_4,KH_2PO_4,3H_2O$, KH_2PO_4, $KH_5(PO_4)_2$, and $2H_3PO_4,H_2O$. Microscopic, chemical, and crystallographic methods have been used in the examination of these phases. No evidence of K_3PO_4 or $K_3PO_4,8H_2O$ has been obtained. The existence of $2K_2HPO_4,KH_2PO_4,H_2O$ and $3K_2HPO_4,2H_2O$ is confirmed and that of $5K_2HPO_4,KH_2PO_4,2(?)H_2O$, $3K_2HPO_4,KH_2PO_4,3H_2O$, and $K_2HPO_4,KH_2PO_4,2H_2O$ reported. E. S. H.

Solubility isotherm of the ternary system K_2O-P_2O_5-H_2O at 0°. M. I. RAVITSCH (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 167—176).—The isothermal curve exhibits 9 branches, corresponding with the solid phases observed at 50° (cf. preceding abstract) with KOH,H_2O excepted. Most of the branches can be followed into the metastable region, and those for $K_3PO_4,3H_2O$, $K_3PO_4,9H_2O$, and $K_2HPO_4,3H_2O$ lie entirely in the metastable region. Solubility data for stable and metastable phases at the same temp. are compared. E. S. H.

Solubility in the system NH_3-H_3PO_4-H_2O. B. A. MUROMTZEV and L. A. NAZAROVA (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 177—184).—Data for 0°, 25°, and 50° are recorded. The phases identified are: $(NH_4)_3PO_4,3H_2O$, $(NH_4)_2HPO_4$, $NH_4H_2PO_4$, $NH_4H_5(PO_4)_2,H_2O$, and $2H_3PO_4,H_2O$. E. S. H.

Equilibrium in aqueous potassium and ammonium nitrates, dihydrogen phosphates, and chlorides. A. G. BERGMANN (Bull. Acad. Sci., U.R.S.S., 1938, Sér. Chim., 229—235).—A review of published work. E. S. H.

Equilibrium in aqueous potassium and ammonium nitrates, dihydrogen phosphates, and chlorides. A. G. BERGMANN and P. F. BOTSCHKAREV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 237—266).—Data are recorded for the temp. ranges from complete solidity to 30°. No evidence of hydrate formation has been obtained. Eutectics are formed at −3·8° (KNO_3 7, KH_2PO_4 9·3, H_2O 83·7%), −16·8° (NH_4NO_3 41·5, $NH_4H_2PO_4$ 2, H_2O 56·5%), and −6·3° ($NH_4H_2PO_4$ 13·2, KNO_3 9·6, H_2O 77·2%). E. S. H.

Equilibrium in ammonium and potassium chlorides and nitrates. A. G. BERGMANN (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 203—216).—Data for the range −20° to 30° are recorded. E. S. H.

Equilibrium in magnesium and potassium chlorides and nitrates. A. G. BERGMANN and G. I. NAGORNI (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 217—228).—Data for the range −33·2° to 30° are recorded. Max. conversion of $Mg(NO_3)_2$ is attained at −23·2°, giving 96% of KNO_3. E. S. H.

Potassium sulphate systems and solid solutions of the glaserite type. S. Z. MAKAROV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 111—122).—A brief summary of work relating to systems containing K, Na, Mg, Ca, SO_4, Cl, and H_2O. The investigations have reference to the economic utilisation of the Ural-Emba K deposits and equilibrium conditions have been determined over a wide temp. range. It is claimed that the individuality of glaserite has been definitely established. E. S. H.

Relationship of beryllium to the vitriol-forming group and to the alkaline-earth metals. II. Double-sulphate formation between sodium and beryllium sulphates in comparison with the vitriols. I. Polytherms of the ternary system $BeSO_4$-Na_2SO_4-H_2O between 0° and 100°. W. SCHRÖDER [with J. HAHNRATH and E. KEHREN] (Z.

anorg. Chem., 1938, **239**, 39—56).—The 0°, 16·5°, 25°, 50°, and 60° isotherms of the system have been determined. No double salts are indicated. F. J. G.

System ammonium selenate–magnesium selenate–water at 30°. R. W. LAWRENCE and G. B. KING (J. Amer. Chem. Soc., 1938, **60**, 1987—1989).—Equilibrium data at 30° are recorded. The system is analogous to the corresponding sulphate system. E. S. H.

Decomposition of zinc carbonate and the action of carbon dioxide on zinc oxide. Mechanism of reactions of the type $A_{solid} = B_{solid} + C_{gas}$. J. ZAWADZKI and (MLLE.) A. ULIŃSKA (Bull. Acad. Polonaise, 1938, **A**, 62—97).—The dissociation pressure of $ZnCO_3$ is > previously reported, but the actual vals. observed are not concordant, depending on the degree of decomp., previous history, nuclear size, and nature of the specimen. At low temp. the rate of dissociation is very slow. The assumption that irregularities are due to formation of solid solutions of ZnO and $ZnCO_3$ (A., 1930, 699) is not in accord with the behaviour of the system or with *X*-ray observations. ZnO does not combine with CO_2, but some gas is adsorbed. At room temp. some CO_2 is adsorbed rapidly by ZnO, this being desorbed again at higher temp. There is also a strong activated adsorption at higher temp., equilibrium being reached after a definite amount of gas has been adsorbed. The solid so saturated with CO_2 can adsorb further amounts of gas to an extent which depends on the pressure, and gives a reversible equilibrium pressure. The results are attributed to the difficulty of formation of nuclei of a new phase. J. W. S.

Equilibrium between metals, sulphides, and silicates in a melt. VI. Equilibrium between aluminium and sodium with their chlorides and fluorides in a melt. W. JANDER and H. HERRMANN (Z. anorg. Chem., 1938, **239**, 65—81).—With a view of studying in a simple case the conditions of equilibrium in melts, the systems $3Na + AlCl_3 \rightleftharpoons Al + 3NaCl$ and $3Na + AlF_3 \rightleftharpoons Al + 3NaF$ have been investigated. Details are given of a procedure by which 0·002% of Na in Al may be determined with an accuracy of 10%. In the chloride system the equilibrium lies so far over on the Al–NaCl side that the metal contains only 0·002—0·005% Na and the melt only 0·003—0·02% Al. The mass-action law is approx. obeyed, the const. $[Na]^3[Al^{\cdots}]$ being $5·2 \times 10^{-10}$ at 825° and $5·8 \times 10^{-10}$ at 900°. The very small temp. coeff. cannot be reconciled with the heats of formation. In the fluoride system, with small percentages of Al in the melt the equilibrium lies nearer to the $Na–AlF_3$ side, and at 1090° the const. $[Na]^3[Al^{\cdots}]/[Na^{\cdot}]^3$ is $\sim 2·0 \times 10^{-9}$, for > 12·8% Al in the melt. Beyond this composition (which corresponds with Na_3AlF_6) [Na] in the metal falls abruptly to ~ 0·004% as found in technical Al, and the corresponding val. for the " const." is $\sim 0·1 \times 10^{-9}$. From the vals. for the " const." above and below the crit. composition the degree of dissociation of the AlF_6''' ion in fused Na_3AlF_6 is found to be > 2%. F. J. G.

Phase-rule studies of soap systems. I. Applicability of the phase rule. J. W. MCBAIN, R. D. VOLD, and M. J. VOLD. **II. System sodium laurate–sodium chloride–water.** J. W. MCBAIN, G. C. BROCK, R. D. VOLD, and M. J. VOLD (J. Amer. Chem. Soc., 1938, **60**, 1866—1869, 1870—1876).—I. A discussion of principles justifying the application of the phase rule to thermodynamically stable colloid systems in true equilibrium, and to soap systems in particular. The phases present in soap systems are defined.

II. Phase-equilibrium data for the systems Na laurate–H_2O and Na laurate–NaCl–H_2O at 60—310° have been determined. True reversible equilibrium, independent of time, is reached, and is defined exactly by the phase rule. E. S. H.

System mercuric iodide–mercuric bromide–absolute alcohol; characterisation of a mercuric bromoiodide by the Raman effect. F. FRANÇOIS (Compt. rend., 1938, **207**, 425—427).—A ternary diagram for the system at 50° is given; the solid phases are mixed $HgBr_2$–HgI_2 crystals of three types. The solutions and the solids obtained on evaporation give Raman νν at 205 ($HgBr_2$), 150 (HgI_2), 233, and 168 cm.$^{-1}$ (attributed respectively to Hg·Br and Hg·I linkings in *HgBrI*). A. J. E. W.

Equilibrium in the reduction of stannic oxide by hydrogen and deuterium. F. ISHIKAWA and S. ANDO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 873—887).—Equilibria in the systems, SnO_2 (*s*) + $2H_2$ (*g*) ⇌ Sn (*l*) + $2H_2O$ (*g*) (I), and SnO_2 (*s*) + $2D_2$ (*g*) ⇌ Sn (*l*) + $2D_2O$ (*g*) (II), have been studied by an apparatus which is described. The equilibrium const., K_1, of (I), for the temp. range 650—759°, can be expressed by $\log K_1^{\frac{1}{2}} = -2295·8/0 + 2·68297$; and for (II), for the temp. range 652—723°, $\log K_2^{\frac{1}{2}} = -1928·6/0 + 2·4323$. The equilibrium const., K_w, of the water-gas system $CO_2 + H_2 \rightleftharpoons CO + H_2O$ is computed by combining $K_1^{\frac{1}{2}}$ and recorded vals. of K_3 of the reaction $\frac{1}{2}Sn + CO_2 \rightleftharpoons \frac{1}{2}SnO_2 + CO$; $K_w = K_1^{\frac{1}{2}}.K_3$. The vals. of K_4 of the exchange reaction H_2O (*g*) + D_2 (*g*) ⇌ H_2 (*g*) + D_2O (*g*) at 600—800°, computed from $K_4 = K_2^{\frac{1}{2}}/K_1^{\frac{1}{2}}$, agree well with those calc. from the equilibrium consts. given by Farkas (A., 1935, 33) for $H_2 + D_2 \rightleftharpoons 2HD$, $H_2O + D_2O \rightleftharpoons 2HDO$, and $H_2O + HD \rightleftharpoons HDO + H_2$. Employing the observed vals. of K_1, the following relations are found for the reaction SnO_2 (*s*) + $2H_2$ (*g*, 1 atm.) = Sn (*l*) + $2H_2O$ (*g*, 1 atm.): $\Delta H = 27619 - 4·40T - 0·003758T^2 + 0·00000165T^3 - 252000/T$; $\Delta G^\circ = 27619 + 4·40\ T \ln T + 0·003758T^2 - 0·0000008825T^3 - 126000/T - 64·375T$; and $\log K_1^{\frac{1}{2}} = -3019·3/T - 1·1077 \log T - 0·0004108T + 0·00000009T^2 + 13774/T^2 + 7·0374$. The vals. of $K_1^{\frac{1}{2}}$ and ΔG° thus calc. agree well with the observed vals., ΔS° decreases slightly with increasing temp. From these results ΔH and ΔG° for the formation of SnO_2 are computed ($\Delta H_{298·1}$, −139,019 g.-cal., $\Delta G^\circ_{298·1}$, −124,087 g.-cal.) and are in moderate agreement with previous vals. W. R. A.

Relations between the chemical constitution of substituted phenols and of ascorbic acid and the size of their solubility products with antipyrine and pyridine. R. LABES and H. BERGSTER-

MANN (Arch. exp. Path. Pharm., 1937, **187**, 389—408).—For the conditions under which a base (*A*) (C_5H_5N at p_H 7·5 or antipyrine at p_H 5·3) and a phenol (*B*) [PhOH, $C_6H_4(OH)_2$, cresol, $C_6H_4Cl{\cdot}OH$, $C_6H_2Cl_3{\cdot}OH$, picric acid] just fail to give a ppt., $[A]^x.[B]$ is const. x is 1—3, usually 2, being so chosen as to make the product const. This product is termed the solubility product. Its size is held to indicate the combining tendency of the components. Combination (*i.e.*, low solubility product) is depressed by hydrophilic (OH) groups and increased by hydrophobic groups ($NO_2 > Cl > Me$); it is also influenced by electric forces, as indicated by dipole moments, for with polar substituents (particularly OH and NO_2) the order of efficacy is $p > m > o$. The ppts. are usually oils, but occasionally cryst. (in some cases only with limited ratios of the components). Owing to its many hydrophilic groups, ascorbic acid gives no ppt.; p_H measurements indicate, however, that antipyrine may bind 0·25 mol. of the acid. The solubility products are so high that combination of these or similar components in the body is an improbable cause of pharmacological effects.

R. S. C.

Thermal dissociation of some chlorides ($CuCl_2$, $PdCl_2$, and $PtCl_4$). J. KRUSTINSONS (Z. Elektrochem., 1938, **44**, 537—539).—The dissociation pressures at various temp. are recorded. The calc. heats of dissociation are respectively 29,000, 37,500, and 24,000 g.-cal. The dissociation of $PtCl_4$ into $PtCl_2$ occurs above 382°; the heat of dissociation of $PtCl_2$ is 29,400 g.-cal. C. R. H.

Heats of dissolution of cæsium perchlorate, rubidium perchlorate, rubidium chlorate, and lead phosphate. K. S. PITZER (J. Amer. Chem. Soc., 1938, **60**, 1828—1829).—Data recorded for infinite dilution and 25° are: $CsClO_4$ 13,260±100, $RbClO_4$ 13,570±60, $RbClO_3$ 11,410±60, $Pb_3(PO_4)_2$ 7860±1000 g.-cal. per mol. E. S. H.

Heat of dissolution of anhydrous aluminium chloride. W. A. ROTH and E. BÖRGER (Z. Elektrochem., 1938, **44**, 540).—The data obtained lead to an average val. 79·43 kg.-cal., which is > vals. hitherto recorded. C. R. H.

Heats and entropy changes accompanying the dissolution of ions in water. D. D. ELEY and M. G. EVANS (Trans. Faraday Soc., 1938, **34**, 1093—1112).—Mathematical. The entropy change accompanying the dissolution of a gaseous ion in H_2O is discussed. A qual. connexion exists between the entropy and the heat of hydration. W. R. A.

Entropies of aqueous ions. W. M. LATIMER, K. S. PITZER, and W. V. SMITH (J. Amer. Chem. Soc., 1938, **60**, 1829—1831).—Vals. calc. from published data have been revised and extended to include 11 additional ions. E. S. H.

Heat of autodiffusion. J. A. M. VAN LIEMPT (Rec. trav. chim., 1938, **57**, 891—892).—Cichocki's formula (A., 1938, I, 346) and the author's (A., 1935, 1310) are interconvertible. F. L. U.

Thermochemical and *X*-ray investigation of the Hedvall effect. R. FRICKE, W. DÜRR, and E. GWINNER (Naturwiss., 1938, **26**, 500).—The Hedvall effect, *i.e.*, the passage of solid substances through an activated state in the course of allotropic transformations and reactions, has been investigated by thermochemical and *X*-ray methods in the case of ZnO–Fe_2O_3 mixtures. An active ZnO was mixed with various samples of $Fe(OH)_3$ and Fe_2O_3 in the ratio $ZnO : Fe_2O_3$, heated for 1 hr. at various high temp., and suddenly cooled. The heats of dissolution, and the width, position, and intensity of lines in the *X*-ray spectra of the products, were compared. At the lower temp. there was an increase in heat of dissolution owing to dehydration of $Fe(OH)_3$ and its conversion into the active form. On further heating the heat of dissolution decreased owing to more perfect formation of the crystal lattice. Shortly before the *X*-ray diagrams indicated spinel formation the decrease in heat of dissolution with rising temp. was < normal and when spinel formation was well advanced it decreased rapidly again. This is due to the strongly deformed lattice of the spinel when first formed, and this is held to be the reason for the existence of the Hedvall effect. A. J. M.

Thermometric study of the neutralisation of weak acids and bases. P. MONDAIN-MONVAL and R. PÂRIS (Compt. rend., 1938, **207**, 338—339).—End-points are indicated by a max. on the curve obtained by plotting rise of temp. against the vol. of the added solutions; these are sharply defined even with weak acids and bases. Typical curves for the titration of H_3BO_3 and H_3AsO_3 with NaOH, and of aq. NH_3 with AcOH, are given. A. J. E. W.

Electrical conductivity of fused mixtures of sodium, potassium, and magnesium chlorides. K. P. BATASCHOV (Metallurg, 1935, **10**, No. 7, 100—113).—Binary and ternary systems have been studied at 650—1000°. CH. ABS. (*e*)

Concentration-conductivity relationship of multivalent electrolytes in aqueous solution. J. P. VAN DER HAMMEN (Rec. trav. chim., 1938, **57**, 851—862).—From the theories of Onsager and Bjerrum a formula expressing the influence of ionic association on the conductivity of multivalent electrolytes is derived. The conductivity of aq. $[Co\ en_3][Fe(CN)_6]$ over the concn. range 0·5—3 × 10^{-4}M is in agreement with the theory. Measurements of light absorption by the solutions indicate no appreciable mutual deformation of the ions. The small ionisation const. (0·643—0·406) is therefore accounted for by powerful Coulomb forces between the highly charged ions. F. L. U.

Thermodynamic dissociation constant of α-benzenesulphonylpropionic acid. I. HEDLUND (Arkiv Kemi, Min., Geol., 1938, **12**, **A**, No. 41, 1—5).—The equiv. conductivity of the hypothetical, completely dissociated acid was determined from measured vals. for the K salt and vals. for HCl and KCl. The relation between conductivity and concn. was then found by multiplying by the concn. and hence from the observed conductivities the concn. of the dissociated acid was deduced. This led first to the "concn. const." and then by the Debye-Hückel theory to the thermodynamic const., k_0. $k_0 = 2{\cdot}79 \times 10^{-3}$. T. H. G.

Behaviour of substances in solution. K. WICKERT (Naturwiss., 1938, **26**, 500—501).—Solutions of HCl gas in liquids which are not proton acceptors (*e.g.*, Et_2O, C_6H_6, SO_2) conduct only when a definite quantity of a proton acceptor (*e.g.*, EtOH) has been added. The effect of addition of EtOH on the conductivity of a solution of HCl in C_6H_6 has been investigated. Three solution states are differentiated: (1) the solution is conducting, and the solute enters into ionic reactions; this occurs when there is a definite min. no. (n) of EtOH mols. to each HCl mol. n can be determined by conductivity measurements. (2) The solution does not conduct, but the solute can still enter into ionic reactions; the HCl mols. are in an excited state. This occurs when the no. of EtOH mols. to each HCl mol. is $<n$. (3) The solution does not conduct and the solute does not enter into ionic reactions; this is the case when there are no EtOH mols. present. The following cells give potentials only if EtOH is present: Hg|HgCl(C_6H_6,HCl)|H (~0·07 v.), Hg|HgCl(Et_2O,HCl)|H (~0·05 v.). A. J. M.

Cd|Cd$^{\cdot\cdot}$ potential in very dilute solution. F. MÜLLER and W. DÜRICHEN (Z. physikal. Chem., 1938, **182**, 233—242).—Using Cd electrodes produced by distillation of the metal in a high vac., it has been shown that the potential of a Cd|Cd$^{\cdot\cdot}$ electrode changes with [Cd$^{\cdot\cdot}$] to a concn. $\ll$ that at which McAulay and Spooner observed a min. val. (A., 1933, 28). During the first hr. the potential drifts towards less negative vals., but the change is then reversed and after about 20 hr. the full potential corresponding with the theoretical val. is attained. The changes occurring with time are probably due to attainment of adsorption and distribution equilibria. With electrodes not prepared in a high vac. the variations of potential with time are reversed. During the first hr. it passes towards more negative vals., and then a reverse change occurs, the final val. attained being approx. that observed by McAulay and Spooner. These changes are attributed to desorption of O_2 from the metal and to formation of $Cd(OH)_2$, respectively. J. W. S.

Potential of the antimony electrode. H. VOGELS (Congr. Chim. ind. Bruxelles, 1935, **15**, II, 1068—1073; Chem. Zentr., 1936, ii, 2105).—The E_{Sb}–p_H curve is discontinuous, consisting of three successive parallel straight lines corresponding with successive oxidation of Sb to SbO$^{\cdot}$, Sb$^{\cdot\cdot\cdot}$, and Sb$^{\cdot\cdot\cdot\cdot\cdot}$. Decomp. potential measurements confirm that oxidation to SbO$^{\cdot}$ may be the primary stage of the process. A. J. E. W.

Electrode potential of iron and platinum in nitric, hydrochloric, and sulphuric acids. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 517—539).—The single electrode potentials, e, of Fe and of Pt in HNO_3, HCl, and H_2SO_4 have been measured relative to a standard calomel electrode. The relation between e and acid has been investigated. No exact relation exists between e and the rate of corrosion of Fe. W. R. A.

Normal Volta potential, V_0, of electrochemical two-phase systems. Temporal changes in surface structure in highly concentrated electrolyte solutions. O. KLEIN and E. LANGE (Z. Elektrochem., 1938, **44**, 562—568).—Vals. of V_0 have been calc. from the data for electron work functions (cf. following abstract). Three of the systems examined afford data in agreement with calculation. For conc. solutions the surface potential decreases with time. The data are discussed. C. R. H.

Electron work functions of metals. O. KLEIN and E. LANGE (Z. Elektrochem., 1938, **44**, 542—562).—Theoretical. Present knowledge and theories are reviewed and discussed. Volta potentials, determined for 45 metals against Hg, lead to a val. 4·52 v. for the work function of Hg. The formation of an oxide film increases the potential, and the removal of this film by rubbing leaves the metal surface in an unstable condition. Further potential changes take place as the metal surface changes to a polycryst. state. Comparison is made between the work function of ions and the corresponding ionisation potential. C. R. H.

Influence of oxygen on the potential of local cathodes. M. STRAUMANIS [with A. LUGGE and E. ENCE] (Korros. u. Metallschutz, 1936, **12**, 148—154; Chem. Zentr., 1936, ii, 2220).—In the absence of O_2, the local cells formed with Pt, Ni, and Fe cathodes are characterised by a low e.m.f.; the e.m.f. and the rate of corrosion increase as soon as O_2 is admitted. The effect is attributed to change in the cathode potential owing to reduction of the [H$^{\cdot}$] at its surface by catalysed combination with O_2. The same effect probably occurs with cathodes of Pb, Sb, Bi, and other metals. A. J. E. W.

Polarographic studies with the dropping mercury electrode. VII. Temperature coefficient of the diffusion currents. D. ILKOVIČ (Coll. Czech. Chem. Comm., 1938, **10**, 249—252).—The temp. coeff. of such currents has been deduced theoretically and evaluated for H$^{\cdot}$, Li$^{\cdot}$, Na$^{\cdot}$, and Zn$^{\cdot\cdot}$. The val. for most ions should be about 1·63% per 1°. K. W. P.

Effects of solvents on polarographic wave heights. E. S. PERACCHIO and V. W. MELOCHE (J. Amer. Chem. Soc., 1938, **60**, 1770—1775).—The wave heights exhibited in aq. solutions are lowered by adding MeOH, EtOH, or PrOH. Differences in the wave heights for equiv. concns. of alkali chlorides are lessened by addition of the alcohols and eliminated by addition of dioxan. $(CH_2{\cdot}OH)_2$, trimethylene glycol, and glycerol also lower the wave heights in aq. alkali chlorides, but with the more viscous solutions the curves obtained are poorly defined. Equiv. concns. of $CdCl_2$, $BiCl_3$, and $PbCl_2$ do not give equal wave heights. E. S. H.

Polarisation in the discharge of ammonium ions and their alkylated derivatives at a mercury cathode. M. LOSCHKAREV and O. ESSIN (J. Gen. Chem. Russ., 1938, **8**, 510—518).—The cathode potential in the electrolysis of aq. NH_4Cl, NH_3MeCl, or NH_2Me_2Cl (dropping Hg cathode) is expressed by $K - (RT \log i)/F - Ri$, where K is const., and i is the c.d. R. T.

Optical investigation of the passivity of iron in nitric and chromic acids. C. W. BORGMANN (J.

Elisha Mitchell Sci. Soc., 1935, **51**, 248).—Passivity in HNO_3 is due to formation of an impermeable film of Fe_2O_3 the thickness of which is 25—35 A. on polished Fe, 10 A. on stainless steel, and 80—100 A. on ordinary steel. In H_2CrO_4 it is due to a film of partly hydrated oxide. CH. ABS. (*e*)

Theory of passivity. XXXII. Anodic passivity of magnesium in alkaline solutions. W. J. MÜLLER and E. NACHTIGALL (Korros. u. Metallschutz, 1938, **14**, 198—205).—The anodic behaviour of Mg in N-NaOH has been studied, and the observation of Baworevsky (J. Elektrochem., 1905, 465) that there are two different passive conditions is confirmed. Below 6 v. the passive Mg has relatively good conductivity, considerable gas is evolved, and little Mg goes into solution. Above 6 v. the conductivity is low, the metal is practically insol., and very little gas is evolved. In each case there is a considerable and rapid fall in c.d. when the potential is first applied to the Mg anode, and this is more slowly followed by a large or small increase. The gas evolved is mainly O_2, with a few % of H_2. The attainment of good conductivity at low voltages is tentatively explained by assuming a change in the structure of the MgO film, and the slight increase in conductivity at high voltages by a widening of the pores. The freshly abraded Mg has an air-formed film 10^{-4} cm. thick, containing pores amounting to 10^{-5}% of its area. C. E. H.

Mechanism of electrolytic processes. V. Adsorption and desorption of hydrogen at platinum electrodes. J. D. PEARSON and J. A. V. BUTLER (Trans. Faraday Soc., 1938, **34**, 1163—1170).—Changes of potential of Pt electrodes in aq. H_2SO_4, NaOH, and HCl on anodic and cathodic polarisation have been investigated at high c.d., using a cathode-ray oscillograph. At active electrodes an adsorbed film of at. H is formed before liberation of H_2 at the cathode, and is removed by anodic treatment at potentials more positive than the reversible H potential. E. S. H.

Electrochemical processes and their value for the absolute definition of metal surfaces. O. ERBACHER (Chem.-Ztg., 1938, **62**, 601—604).—A general review (cf. A., 1937, I, 84, 625; 1938, I, 510). W. R. A.

Semiquinone radicals in the indamine and indophenol groups. G. SCHWARZENBACH and L. MICHAELIS (J. Amer. Chem. Soc., 1938, **60**, 1667—1678).—Potentiometric titration of Bindschedler's green and of phenol-blue with reduced rosinduline GG or $TiCl_3$, and of the reduced dyes with Br–H_2O or $K_3Fe(CN)_6$, furnishes curves the slopes of which indicate the intermediate formation of semiquinone radicals. Ionisation consts. for the reduced, oxidised, and half-oxidised forms have been determined and checked by spectrophotometric measurements. Electronic formulæ are given for the possible states of ionisation of the three forms of the above dyes and of phenol-indophenol. F. L. U.

Free acetyl.—See A., 1938, II, 390.

Reaction velocity. P. VAN RYSSELBERGHE (Bull. Acad. roy. Belg., 1938, [v], **24**, 353—356).—Mathematical. N. M. B.

Proof of De Donder's fundamental hypothesis when the reaction velocity is a function of the state of the system. R. DEFAY (Bull. Acad. roy. Belg., 1938, [v], **24**, 347—352).—Mathematical. N. M. B.

Evaluation of specific reaction rates in chain reactions. G. K. ROLLEFSON (J. Physical Chem., 1938, **42**, 773—781).—A review. Uncertainties in the evaluation of the efficiencies of chain-starting and chain-terminating reactions and the determination of rate consts. for chain-continuing reactions are discussed. J. W. S.

Theory of explosive reactions. H. MURAOUR (Trans. Faraday Soc., 1938, **34**, 989—992).—A résumé of the theory (A., 1932, 233) is given and the conclusions reached from it as to the action of a vac. on the propagation of explosive reactions are supported by experimental data. W. R. A.

Energy and entropy of activation of the reaction between nitric oxide and chlorine. I. WELINSKY and H. A. TAYLOR (J. Chem. Physics, 1938, **6**, 466—472).—The concept of entropy of activation, S, and methods for its calculation are discussed. Details are given for the experimental determination of the energy of activation, E, of the formation of NOCl from NO and Cl_2; E increases with temp. and from it S may be evaluated. Previous work is criticised. W. R. A.

Reaction of oxygen atoms with methane.—See A., 1938, II, 387.

Kinetics of pyrolysis of *iso*butyl iodide. J. L. JONES (J. Amer. Chem. Soc., 1938, **60**, 1877—1882).—The rate at 550—600° K. is given by $-d[Bu^{\beta}I]/dt = k[Bu^{\beta}I][I_2]^{\frac{1}{2}}$. A mechanism consistent with the experimental data is proposed. E. S. H.

Explosiveness of mixtures of methyl chloride, methyl bromide, and air. C. RANDACCIO and T. GIAVARRINI (Annali Chim. Appl., 1938, **28**, 254—258).—The most explosive mixture of MeCl and air (viz., MeCl 11·5, air 82·2 vol.-%) is rendered safe (to electric sparking of a described type) by addition of 1·3 vol.-% of MeBr. F. O. H.

Detection of radicals in the chemical decomposition of alkyl iodides.—See A., 1938, II, 387.

Electrical ignition of mixtures of ether vapour, air, and oxygen. W. M. THORNTON (J. Inst. Elect. Eng., 1938, **83**, 145—155).—The conditions of ignition of various Et_2O–air and Et_2O–O_2 mixtures by coil, circuit break, and single jump sparks, and by hot and fused wires have been investigated. Mixtures containing 3—80% of Et_2O in O_2 can be ignited by hot wires, but the limits of composition for ignition by sparks are narrower. "Fizzling" sparks between tufts of fine wire, such as are produced at breaks in flex lines, readily cause ignition, especially when a.c. is used. Electrical circuits in operating theatres should be loaded with such resistance that the possible current passing is $\gtrsim$ a certain val. J. W. S.

Risk of explosion due to electrification in operating theatres of hospitals.—See A., 1938, III, 840.

Salt effect in the paramagnetic conversion of para-hydrogen. M. CALVIN (J. Amer. Chem. Soc., 1938, **60**, 2003).—The rate consts. for the conversion by solutions of diamagnetic salts are independent of the concn. of the salt if the change in solubility of H_2 is allowed for. E. S. H.

Polymerisation and condensation of formaldehyde in heavy water.—See A., 1938, II, 392.

Hydrolysis of methyl iodide. R. A. OGG, jun. (J. Amer. Chem. Soc., 1938, **60**, 2000—2001).—The reaction in 50 vol.-% MeOH–H_2O is of the first order with respect to MeI, but is complicated in the later stages by formation of a considerable amount of I in accordance with $MeI + H_3O^+ + I^- \rightarrow CH_4 + 2I + H_2O$. The rate coeffs. at 55° and 100° have been calc. and compared with those for the reaction in H_2O. E. S. H.

Kinetics of hydrolysis of ethyl orthoformate in deuterium oxide–water mixtures. F. BRESCIA and V. K. LA MER (J. Amer. Chem. Soc., 1938, **60**, 1962—1967).—The rate has been studied in 0—100% H_2O–D_2O in presence of NaOAc–AcOH buffers at 25° by a dilatometric method. The sp. catalytic const. for D_3O^+ is 2·35 times that for H_3O^+. The greater val. for D_3O^+ is explained as a shift in the equilibrium $S + H^+ \rightleftharpoons SH^+$ (where S = substrate) in favour of the D^+ complex. E. S. H.

Kinetic study of acidolysis phenomena. H. GAULT and A. CHABLAY (Compt. rend., 1938, **207**, 293—295; cf. A., 1937, II, 4).—The reversible reactions between Me palmitate and the acids $R{\cdot}CO_2H$ (R = Me, Et, Pr^a, Bu^a, or n-C_5H_{11}) have been studied. The mass-action law is obeyed, K at 175° being ~1 in each case; K is probably independent of temp. A. J. E. W.

Fission of esters of phosphoric acid.—See A., 1938, II, 399.

Kinetics of decarboxylation of certain organic acids. R. A. FAIRCLOUGH (J.C.S., 1938, 1186—1190).—The decarboxylation of aq. solutions of the Na salts of $CCl_3{\cdot}CO_2H$, $CBr_3{\cdot}CO_2H$, $CPh{:}C{\cdot}CO_2H$, and $CH_2(CO_2H)_2$, measured over a range of temp., is in each case kinetically of the first order. Qual. observations are recorded on the behaviour of p-nitro- and 2 : 4-dinitro-phenylacetic, dibromogallic acid, and $CI_3{\cdot}CO_2H$. A mechanism is proposed for the monobasic acids in which the rate-determining step is the rupture of the C–C bond. This yields a simple explanation of the correlation between E and log PZ which is observed for these acids. It is probable that a different mechanism is operative for the dibasic acids. H. J. E.

Benzilic acid rearrangement.—See A., 1938, II, 408.

Velocity of the hydrogen atom exchange of acetone in dilute aqueous sodium hydroxide. W. D. WALTERS and K. F. BONHOEFFER (Z. physikal. Chem., 1938, **182**, 265—274).—The velocity of introduction of D into $COMe_2$ in aq. NaOH $\propto$ the $[OH']$ and increases rapidly with increasing $[D_2O]$. The velocity of the reaction in pure D_2O is deduced. The exchange is attributed to the equilibrium $COMe_2 + OH' \rightleftharpoons COMe{\cdot}CH_2' + H_2O$, and the results are compared with those for the action of I on $COMe_2$ in alkaline solution (A., 1928, 1101). J. W. S.

Thermal rearrangement of *N*-chloroacetanilide in aqueous solution.—See A., 1938, II, 404.

Kinetic reinvestigation of isomerisation of camphene hydrochloride.—See A., 1938, II, 371.

Nuclear formation in the thermal decomposition of solids. W. E. GARNER (Trans. Faraday Soc., 1938, **34**, 940—946).—Decomp. of solids is associated with the formation of nuclei at places where the lattice structure has been disorganised by impurities or mechanical damage. The shape of the nuclei is determined by the rate of growth in different directions, in turn depending on the structure of the crystal, of its product, and of the interface. The growth of the no. of crystals does not follow any simple law, there being definite evidence that there is a variable activation energy of nuclear formation. Unscratched crystals show a period of induction (t) before the nuclei become visible. During t very small nuclei are probably growing at a rate < the linear rate found to hold for large nuclei. t can be accounted for by two alternative explanations which can be expressed by the same mathematical formulation. Experimental evidence is advanced in support of the view that in certain cases of exothermic solid decomp. nuclei grow according to a chain mechanism, and must, therefore, in the early stages of their growth, possess a diffuse structure. W. R. A.

Absolute rates of heterogeneous reactions. I. General theory of adsorption. G. E. KIMBALL (J. Chem. Physics, 1938, **6**, 447—453).—The statistical theory of reaction rates, developed for homogeneous reactions by Eyring (A., 1935, 586, 1205), is extended to heterogeneous reactions. The derived expressions for the rates of adsorption and desorption have the same forms as the rates of homogeneous reactions, provided that for the activated state a "super-partition" function, formed by the addition of the partition functions for all the active spots, is used. The application of the pseudo-thermodynamical form of the rate const. to various mechanisms of adsorption is discussed. W. R. A.

Detonation or explosion arising out of thermal decomposition. W. E. GARNER (Trans. Faraday Soc., 1938, **34**, 985—989).—The hypothesis that the detonation arising out of the thermal decomp. of explosives is due to simultaneous decomp. of a small no. of neighbouring mols. in the solid is examined critically by reference to available data. W. R. A.

Decomposition of nitrogen iodide. F. R. MELDRUM (Trans. Faraday Soc., 1938, **34**, 947—950).—When NI_3,NH_3 is dried over P_2O_5 at 2×10^{-3} cm. the thermal decomp. proceeds slowly, then accelerates, and finally stops; further pumping re-starts the decomp. The suggested explanation for these data was that I_2 was the retarding agent (cf. A., 1936, 439). I_2 vapour at various pressures has been added to the reaction vessel but no retardation is exhibited. Analyses of the decomp. products show that

$N_2 : NH_3 : I_2 = 1 : 2 : 3$ and thus, at low pressures, the reaction which occurs is $2NH_3,NI_3 = N_2 + 2NH_3 + 3I_2$. The mechanism involves initial removal of NH_3, leaving NI_3 which then decomposes. The retarding agent is NH_3 which is adsorbed on the surface, probably with formation of compounds containing 1, 2, 3, and 12 mols. of NH_3. On the other hand, nuclei of NI_3 may be present on the crystal surface and be "active" in the decomp. when NH_3 is absent; in presence of NH_3 their no. is so reduced that the reaction is slowed down or stopped. The decomp. is a chain reaction with chains (of infinite length) which are broken by NH_3. H_2O vapour also retards the decomp. and probably acts as a chain breaker. The adsorbed layer of NH_3 is very stable at $<0°$ and the reaction can be started only with difficulty when such a layer exists. W. R. A.

Autoxidation of *n*-hexadecane. G. ARDITTI (Compt. rend., 1938, **207**, 155—157).—The autoxidation of n-$C_{16}H_{34}$ in a heterogeneous system shows an induction period (A., 1935, 1208). The influence of temp. on the reaction velocity has been studied. For any temp. a period of const. reaction velocity (V) is found beyond this period of induction, and log V for different temp. is a linear function of temp. Reaction velocities and energies of activation show that, of all the reactions which can take place in the autoxidation, that of min. speed is the same at all temp. studied (100—152°). W. R. A.

Part played by surface oxides in the oxidation of carbon. R. F. STRICKLAND-CONSTABLE (Trans. Faraday Soc., 1938, **34**, 1074—1080).—The structure of C, as elucidated by X-ray analysis, indicates the presence of very strong free valencies at the edge of the crystal which should be capable of forming very stable compounds. The high m.p. of C supports this view. All properties of the surface oxide complex (I) can then be explained by assuming it to consist of a no. of distinct covalent compounds. The decomp. of (I) over a wide temp. range is accounted for by the different thermal stability limits of these compounds. The kinetics of the oxidation of C at moderate temp. is explained by assuming the formation of a distinct intermediate compound, which is less stable than (I) and thus more reactive towards a further mol. of oxidising gas coming from the gas phase, giving CO_2 in a first-order reaction. The interaction between N_2O and CO in the presence of C is explained as a first-order reaction between CO and the intermediate. W. R. A.

Mechanism of reactions of the type: solid = solid + gas. J. ZAWADZKI and S. BRETSZNAJDER (Trans. Faraday Soc., 1938, **34**, 951—959).—In the thermal decomp. of coarsely-ground calcite, in the dissociation of $CdCO_3$, and in the formation of $CdCO_3$ from CdO and CO_2 spurious equilibria are established in which a variation in pressure ensues for the least change in temp. The velocity of the reactions diminishes almost to zero at a certain distance from equilibrium. These spurious equilibria are caused by sorption and slow rates of crystallisation. The equilibria relating to the dissociation and formation of $CaCO_3$, $CdCO_3$, and $ZnCO_3$ are discussed. W. R. A.

Surface state and oxidisability of cobalt. (MME.) G. CHAUVENET (Compt. rend., 1938, **207**, 360—362).—The rate of absorption of O_2 by Co at 1200—1350° K. decreases on keeping at room temp. for 2—12 months, the activation energy of the absorption remaining const. With fresh surfaces the wt. of O_2 absorbed is not $\propto t^{\frac{1}{2}}$ (cf. A., 1937, I, 571), owing to the rates of reaction (v_r) and of diffusion through the surface layer (v_d) being of the same order of magnitude. On keeping v_d is decreased by progressive formation of a protective film. Expressions giving v_r and v_d are derived. A. J. E. W.

Influence of the radius of curvature on the velocity of oxidation of cobalt. (MME.) G. CHAUVENET (Compt. rend., 1938, **207**, 398—400).—Expressions for the rate of oxidation of wire and spherules, confirmed previously for Ni (cf. A., 1935, 1466; 1936, 434), also apply to the oxidation of Co at 850—1100°. A. J. E. W.

Effect of annealing temperature on corrosion of magnesium alloys.—See B., 1938, 1055.

Rate of dissolution of wollastonite in sodium silicates in relation to temperature. O. K. BOTVINKIN and A. A. GUREVITSCH (Monograph on Phys. and Phys. Chem. of Glass, Moscow, 1933, 34).—The times of dissolution (in min.) of 3-g. samples of wollastonite ground in an agate mortar in 20 g. of the $Na_2Si_2O_5 + 0{\cdot}7SiO_2$ eutectic were at 1035°, 1440; 1125°, 600; 1162°, 300; 1210°, 120; 1240°, 60; 1260°, 30 min. CH. ABS. (e)

Effects of argon and helium on explosions of carbon monoxide and oxygen. E. F. FIOCK and C. H. ROEDER (Nat. Advisory Comm. Aeronautics, 1936, Rept. No. 553, 1—10; cf. A., 1937, I, 86).—Addition of A or He, except possibly in the case of small additions of the latter gas, reduces both the flame speed and the expansion ratio for mixtures of CO, O_2, and H_2O. The effect is independent of the ratio of CO to O_2. CH. ABS. (e)

Polymerisation of *iso*butene. E. W. R. STEACIE and G. SHANE (Cand. J. Res., 1938, **16**, B, 210—212).—Polymerisation of mixed *iso*butenes at 400—468°/600 mm. is markedly autocatalytic. O_2 is also a catalyst. The initial reaction rate indicates a second-order reaction with an activation energy 43·4±4 kg.-cal. and a collision efficiency 4×10^{-4} (*i.e.*, normal for this type of reaction; cf. Bawn, A., 1936, 296). R. S. C.

Catalytic effects in the bromination of toluene.—See A., 1938, II, 401.

Temperature coefficients of the base-catalysed decomposition of nitramide in deuterium oxide. S. LIOTTA and V. K. LA MER (J. Amer. Chem. Soc., 1938, **60**, 1967—1974).—The velocity of anion catalysis decreases approx. 2·3-fold at 15° and 2·0-fold at 25° for OAc′, OBz′, and salicylate ions on passing from H_2O to 91·5% D_2O. The Brönsted equation $G = kK_A^{\alpha}$ relating velocity and dissociation consts. holds accurately in D_2O; α is not affected by temp. or isotopic substitution. The difference in the free energy of activation between H and D forms is practically const. for the anion catalysts at 25°, but the corresponding entropy and energy differences do

not remain const. For a given solvent the entropy factor mainly determines the rate for a series of anions, whilst for the same anion catalyst the energy of activation is the more important factor in D substitution. The influence of temp. and D substitution suggests that the spontaneous H_2O reaction has a mechanism different from the anion-catalysed process. E. S. H.

Kinetics of co-ordination reactions in the cobaltammine series. II. Effects of nitrate and sulphate ions on the rate of aquotisation of the chloropentammine ion. F. J. GARRICK (Trans. Faraday Soc., 1938, **34**, 1088—1093).—The rate of liberation of Cl′ ions by H_2O from $[Co(NH_3)_5Cl]^{\cdot\cdot}$ is increased by electrolytes (A., 1937, I, 248). The acceleration is sp. for anions but independent of the cation. The influence of sulphates and nitrates and their mixtures on the rate has been investigated at 25°. Sulphates have a much greater influence than nitrates; the acceleration by sulphates of univalent cations is > that for bivalent cations. Relationships between rate and ionic strength are given. W. R. A.

Kinetics of the reaction between formates and iodine. E. JOZEFOWICZ (Congr. int. Quim. pura apl., 1934, **9**, II, 268—275; Chem. Zentr., 1936, ii, 3774—3775; cf. A., 1929, 771).—Reaction between HCO_2H (Na, K, and Ca salts) at 30°, 40°, and 50° and I is more complicated than that between HCO_2H and Br and is affected by $[H^{\cdot}]$ and $[I_3']$, as is shown by results obtained with only slight excess of KI. At lower temp. k is const. (after an induction period) but increases during the reaction at higher temp. and [I], suggesting reaction between I_3' and HCO_2H. Temp. coeffs. are $k^{40}/k^{30} = 3{\cdot}3$; $k^{50}/k^{40} = 3{\cdot}0$; $k^{60}/k^{50} = 3{\cdot}2$; activation energy = 23 kg.-cal. KNO_3, Na_2SO_4, and K_2SO_4 accelerate, whereas Li, Na, K, Ca, Sr, and Ba bromides, Na, Mg, Ca, and Sr nitrates, and Li, Na, and Mg sulphates inhibit, reaction. Br is the most effective anion and bivalent are more effective than univalent cations (cf. A., 1926, 474). K, the dissociation const. of HCO_2H, and $[I_2][I']/[I_3']$ are correlated but no connexion between the temp. coeff. of k and the salt effect was found. A. H. C.

Catalytic decarboxylation of β-keto-acids.—See A., 1938, II, 392.

Dehydrogenating autoxidation and biological oxidation. I. A. SZENT-GYÖRGYI. **II. Iron and copper complexes.** I. BANGA. **III. Oxidation-reduction potential of the iron-pyrocatechol complex. IV. Inhibition by carbon monoxide and cyanides of the oxidation of ferro-pyrocatechol complex.** K. LAKI and G. PAPP. **V. Autoxidation of sulphite.** M. GERENDÁS. **VI. Oxidation-reduction of ascorbic acid and methylene-blue.** F. B. STRAUB. **VII. Inhibition of the action of dehydrogenases and of polyphenol-oxidase by substances which yield copper complexes.** I. BANGA and E. PORGES. **VIII. Existence of ascorbic acid oxidase.** F. B. STRAUB (Z. physiol. Chem., 1938, **254**, 147—164, 165—175, 175—176, 177—184, 184—192, 192—199, 200—204, 205—206).—I (cf. A., 1934, 992). The evidence presented in parts II—VIII supports the view that the autoxidation of the substances considered is a special case of oxidation-reduction and that many dehydrogenases are metal-protein compounds. In the cells no free metallic oxide is produced since it is the metal complexes which undergo autoxidation. The specificity of the complexes accounts for that of the dehydrogenases and oxidases.

II (cf. Wieland and Binder, A., 1912, i, 445). Pyrocatechol (I) combines with Fe^{II} in absence of O_2 yielding a colourless complex which is reversibly oxidised by atm. O_2 at p_H 5—7·5 to a very stable violet complex of Fe^{III} which is reduced by $Na_2S_2O_4$ (but not by cysteine or ascorbic acid) to the colourless complex. Oxidation, accompanied by slow uptake of O_2, of (I) by Fe^{III} is checked because equilibrium is very rapidly attained in the system Fe^{II}–Fe^{III}–ferrous complex–ferric complex–quinone–quinone complex. Substances which form Fe complexes reversibly compete with (I) for Fe and the degree of decolorisation of the violet complex is a measure of the relative complex-forming powers. In the production of Fe–CN complexes the irreversible formation of ferro- and ferri-cyanide seems to be preceded by reversible formation of intermediate products. Fe seems to form mixed complexes, *e.g.*, containing CN and other residues, and CN sometimes increases the catalytic power of Fe (as in the oxidation of $Na_2S_2O_3$). Cu^{II} behaves like Fe^{III} but has greater affinity for :CO, :N, and $\cdot NH_2$ and yields a violet complex with $(CH_2{\cdot}NH_2)_2$. Fe and Cu accelerate the autoxidation of *o*-diphenols and *o*-phenylenediamines (production of 5-membered rings) and Cu (but not Fe) accelerates that of the corresponding *p*-compounds (production of 7-membered rings). Most substances which yield Fe complexes accelerate the oxidation of Fe^{II} to Fe^{III} and some substances accelerate the oxidation without yielding complexes (with Fe^{III} at least). Ascorbic acid also yields a colourless Fe^{II} complex and a Fe^{III} complex (*compound* with NH_3, $C_{11}H_{19}O_{12}NFe$) of low stability, violet at p_H 6—9. The equilibrium in the Fe^{III}–ascorbic acid system checks oxidation of the acid by Fe^{III}.

III. At p_H 5 the Fe^{II}– and Fe^{III}–(I) complexes form a reversible oxidation-reduction system having $E_0 = +0{\cdot}293$ v.

IV. Photometric measurements show that the oxidation of the Fe^{II}– to the Fe^{III}–(I) complex is a unimol. reaction, the rate of which is proportional to the O_2 tension. The rate increases exponentially as the p_H increases. CN′ competes with (I) but not with O_2 for Fe but inhibits the oxidation only when in excess. CO also inhibits the oxidation, competing with O_2 but not with (I) for Fe. CO inhibits the oxidation of the Fe^{II}– to the Fe^{III}–citrate complex but not the autoxidation of (I) catalysed by Fe.

V. The autoxidation of $NaHSO_3$, which depends greatly on p_H, is catalysed by metals present as impurities; some of these inhibit, whilst others, especially Cu^{I}, Cu^{II}, Fe^{II}, or Fe^{III}, activate, the process. When Fe is the catalyst the autoxidation is limited above p_H 5·2 by the reduction of the Fe (Fe^{III} complex) and below p_H 5·2 by oxidation of the Fe (Fe^{II} complex), the equilibrium of the system being dependent

on p_H. The autoxidation is inhibited by most substances which form complex with Fe but accelerated by others, especially KCN, $(CH_2{\cdot}NH_2)_2$, and C_5H_5N. Many substances which form complexes with Cu accelerate the autoxidation.

VI (cf. Ball, A., 1937, I, 246). The spontaneous reduction of methylene-blue by ascorbic acid is not dependent on the presence of metals, is accelerated by light, and is dependent on p_H (1—4·5), being most pronounced at p_H approx. 2. Reduction catalysed by Cu is less affected by light but is affected by p_H in almost the same way. At $p_H > 4{\cdot}5$ Cu yields a complex with methylene-blue and inhibits the acceleration by light. CO or very low concns. of HCN, HCNS, or $H_2S_2O_3$ inhibit the reduction catalysed by Cu but have no effect on the spontaneous reduction.

VII. Org. substances, approx. ∝ the readiness with which they yield complexes with Cu, inhibit the action of succinic dehydrogenase and of the other dehydrogenases of muscle. With inorg. substances the parallelism is less pronounced, some which have poor complex-forming power being powerful inhibitors. Most substances which yield Cu complexes have no effect on the action of polyphenol oxidase.

VIII (cf. Stotz *et al.*, A., 1937, III, 352). Cucumber juice, crude or partly purified by centrifuging, accelerates the autoxidation of ascorbic acid 5 to 10 times as much as does the solution obtained by evaporating the juice to dryness, igniting the residue, evaporating the ash with HNO_3, and dissolving in H_2O. Hence if Cu is the activator of the autoxidation, it acts in combination with protein, the compound being ascorbic acid oxidase. W. McC.

Comparative rates of amylase action on starches.—See A., III, 845.

Sucrose inversion by baker's yeast as a function of temperature.—See A., 1938, III, 846.

Reaction between hydrogen and oxygen on metallic palladium. T. TUCHOLSKI (Z. physikal. Chem., 1938, **B**, **40**, 333—346).—The order of the reaction depends on whether O_2 or H_2 is admitted first to the reaction vessel. The reaction is of the first order or of zero order according to whether a Pd–O or a Pd–H surface is formed on the Pd. Substituting D_2 for H_2 leads to a lower reaction velocity in the case of the first-order reaction, but no difference is observed in the velocity of the zero-order reaction. Possible mechanisms are discussed. C. R. H.

Catalytic properties of defined, active oxides. G. M. SCHWAB and H. NAKAMURA (Ber., 1938, **71**, [*B*], 1755—1762).—The rate of decomp. of N_2O at active specimens of MgO and CuO characterised with regard to the cause of their difference in energy by Fricke (A., 1938, I, 529) has been investigated. In the case of MgO the damage by heat to the catalytic activity is caused by increase in the heat of activation with simultaneous but inadequate increase of the action const. The increase is attributed to the disappearance of lattice deformations. In the case of CuO the diminution of catalytic activity by heat is consequent on a great decrease of action const. with simultaneous but inadequate depression of the heat of activation. The great heat of activation of the more active, finely-divided specimens is probably due to the enclosure of the cryst. surfaces in amorphous material + H_2O; the high action consts. are due to an increased capacity of adsorption. H. W.

Amorphous and crystallised oxide hydrates and oxides. XLV. Oxidation of aqueous solutions of organic dyes by hydrogen peroxide in presence of röngenographically amorphous ferric hydroxide as catalyst in a heterogeneous system. A. KRAUSE and A. POLAŃSKI (Ber., 1938, **71**, [*B*], 1763—1765).—Oxidation of many dyes, particularly indigo-carmine, is readily effected by H_2O_2 in presence of orthoferric hydroxide. The change is $O\langle^{\dot{F}e{\cdot}OH}_{\dot{F}e{\cdot}OH}$ (I) + $H_2O_2 = O\langle^{\dot{F}e{\cdot}O}_{\dot{F}e{\cdot}O}$ (II) + $2H_2O$ and (II) + indigotin → (I) + isatin. Oxidations can be repeated as desired with the same sample of catalyst whereas finality is soon reached with acidified $FeSO_4$ as inductor. H. W.

Fission of esters of phosphoric acid in presence of lanthanum hydroxide.—See A., 1938, II, 399.

Reactions in the solid state at high temperatures. XIX. Intermediate states arising in the formation of a spinel from magnesium oxide and alumina. W. JANDER and H. PFISTER (Z. anorg. Chem., 1938, **239**, 95—112).—The intermediate states have been studied by following the variation in the properties of equimol. mixtures of MgO and Al_2O_3 after heating to various temp. The properties studied were the catalytic activity for gas reactions, the adsorptive power for H_2O vapour and for dissolved dyes, and the *X*-ray diagram. Two clearly-marked stages occur at 800° and 920°. The first, characterised by max. of catalytic power and hygroscopicity, corresponds with the max. of disorder in the reaction zone, and the second, at which the catalytic and adsorptive powers begin to decrease rapidly and the lines of the spinel structure appear, corresponds with the beginning of crystallisation of the product. Other less definitely-marked stages occur at 400—500° and 500—600°. F. J. G.

Catalytic interaction of hydrogen and deuterium with ethylene and deuteroethylenes on copper. G. JORIS, H. S. TAYLOR, and J. C. JUNGERS (J. Amer. Chem. Soc., 1938, **60**, 1982—1986).—Rates of addition of H_2 and D_2 to C_2H_4, $C_2H_2D_2$, and C_2D_4 on active Cu catalysts at −20° to 40° have been determined. In each case the rate of addition of D_2 is ~50% of that of H_2. No differences are observed in the initial rates of hydrogenation of the several ethylenes on catalysts of high activity, but small differences appear as the catalyst slowly deteriorates, the D-rich mols. reacting more rapidly. Collision rates of H_2 and D_2 with the surface are inadequate to account for the relative rates of addition; zero-point energy differences are also involved. The apparent activation energies of the reactions are about 11·5 kg.-cal. E. S. H.

Hydrogenation of ethylene and partly deuterised ethylene on catalytic metal surfaces. G. G. JONES and J. C. JUNGERS (J. Amer. Chem. Soc., 1938, **60**, 1999—2000).—The times of half-reaction for hydro-

genation of C_2H_4 and $C_2H_2D_2$ in presence of Ni at 64°, Pt at −21°, and Co at 0° are 28 and 13, 18 and 12, and 3·5 and 2·8 min., respectively (cf. preceding abstract). R. S. C.

Effect of certain metals on the oxidation process of carbon. J. D. LAMBERT (Trans. Faraday Soc., 1938, **34**, 1080—1082).—Atoms of Fe and Mn, when adsorbed on the active parts of a C surface, appear to catalyse the decomp. of the surface oxide complex, which is otherwise stable at the temp. employed (250—500°), and actually block the surface available for oxidation by the first-order reaction $C + O_2 = CO_2$, which takes place at a clean C surface. The catalytic activity of C for the reaction between CO and O_2 is also greatly diminished by the presence of adsorbed Fe and Mn. W. R. A.

Water content of some oxides and their catalytic action in the decomposition of alcohols. P. SPINOGLIO (Atti Mem. R. Accad. Padova, 1935, **51**, 25—35; Chem. Zentr., 1936, ii, 930).—$Al(OH)_3$ gel dried for a definite time at 150—300° in a stream of N_2 had a lower H_2O content than that dried in C_2H_4. Vals. for air and H_2 were intermediate. With decreasing H_2O content in the gel, the quantity of C_3H_4 produced in the dehydration of EtOH increases, and that of H_2 decreases. Similarly with Cr_2O_3 [from $Cr(OH)_3$ gel] and PrOH, decrease in H_2O in the oxide increased the C_3H_6 and decreased the H_2. H. J. E.

Influence of irradiation on solid catalysts in gas reactions. G. COHN and J. A. HEDVALL (Z. anorg. Chem., 1938, **239**, 114—125).—The catalytic activity for gas reactions of a no. of phosphorescent and other solid substances, when irradiated with visible and ultra-violet light, has been investigated. In only one instance (N_2O and H_2 on a BN phosphor) was a very small increase in activity observed. F. J. G.

Selective hydrogenation of ethylenic compounds in presence of palladium and platinum catalysts. II. N. K. JURASCHEVSKI (J. Gen. Chem. Russ., 1938, **8**, 438—444).—The relative velocities of hydrogenation of ethylenic compounds in presence of Pd or Pt catalysts cannot be predicted from the structure of the compounds, nor can the rate of hydrogenation of constituents of mixtures be deduced from the hydrogenation curves. It is suggested that more trustworthy information is given by heat of hydrogenation data. Pd catalysts differ from Pt in their greater activity in the hydrogenation of phenylated ethylenes. R. T.

Catalytic formation of methane from carbon monoxide and hydrogen. V. Promoter effect on nickel catalyst. K. M. CHAKRAVARTY (J. Indian Chem. Soc., 1938, **15**, 245—248).—Reduction of pure $Ni(OAc)_2$ with H_2 is more thorough in presence of a little $Ce(NO_3)_3$ with V_2O_5 or, better, $Ce(NO_3)_3$ with $Cr(OAc)_3$. The greater efficiency of the catalysts, deposited on pumice, is exemplified by the reaction of CO with H_2 at 300°, but the possibility of direct influence of the promoters on the reaction is not elucidated. F. R. G.

Combination of bromine with vinyl bromide at glass surfaces. G. WILLIAMS (Trans. Faraday Soc., 1938, **34**, 1144—1152).—Kinetic investigations show that the reaction in a gaseous system, forming $CH_2Br{\cdot}CHBr_2$, is a surface reaction in the dark between 0° and 50°. The rate falls sharply with rising temp., and is given by $dx/dt = k_3[CH_2{:}CHBr][Br]^2$. When $CH_2{:}CHBr$ is in excess, a single val. of k_3 covers the reaction, but under other conditions an initial rapid reaction is damped and succeeded by a third-order reaction with a reduced velocity coeff. The damping is connected with the condensation of the reaction product. On certain inert surfaces the reaction agrees with $dx/dt = k_2[CH_2{:}CHBr][Br]$; the presence of H_2O vapour accelerates the reaction and restores third-order kinetics. The mechanism is discussed. E. S. H.

Importance of surface on course of chemical reactions. R. HAUL (Z. Ver. deut. Ing., 1938, **82**, 1021—1024).—A lecture. R. B. C.

Reactions in concentrated sulphuric acid. IV. Carbon oxysulphide. J. MILBAUER [with J. MÝLA] (Chem. Obzor, 1936, **11**, 65—68; Chem. Zentr., 1936, ii, 2701; cf. A., 1938, I, 406).—COS begins to react with H_2SO_4 at 150° (in presence of Pd at 90°; other catalysts in order of decreasing efficiency are Se, Pt, Ag, Cu, V, Hg, Pb, Te, Sn, Bi, Cd, Si, Sb, Zn, Fe, As, Mo, W, and a limit to the efficiency of increasing quantities was noted), the reaction rate increasing rapidly with temp. The thermal decomp. of COS into CO, S, CO_2, and CS_2 is accelerated by H_2SO_4, and CO and CS_2 are further oxidised to CO_2, SO_2, and S. A. H. C.

Sulphuric acid manufacture. Vanadium oxide catalyst.—See B., 1938, 1032.

Catalytic hydrogenation of carbon disulphide.—See B., 1938, 1012.

Catalytic hydrogenation of octenes to octanes.—See B., 1938, 1008.

Promoter effect on a nickel catalyst.—See B., 1938, 1005.

Catalytic gas reactions.—See B., 1938, 994.

Nickel-copper [fat-hardening] catalysts from the pyridine complex salts of the formates.—See B., 1938, 1065.

Catalysts in phenol-formaldehyde condensations.—See B., 1938, 1072.

Fractionation of lithium and potassium [and nitrogen] isotopes by chemical exchange with zeolites. T. I. TAYLOR and H. C. UREY (J. Chem. Physics, 1938, **6**, 429—438).—A 38% LiCl solution was electrolysed at 36° in the cell previously described (A., 1937, I, 470) with a flowing Hg cathode and a graphite anode. After 450 g. of solution had been electrolysed to 5 g. the ratio $^7Li : ^6Li$ was 13·8 and the fractionation factor 1·039. A mass spectrometer for analysing isotopic abundance ratios is described. The normal abundance ratios, $^7Li : ^6Li = 11{\cdot}71 \pm 0{\cdot}14$ and $^{39}K : ^{41}K = 14{\cdot}10 \pm 0{\cdot}09$, have been determined. Fractionation of Li isotopes has also been effected by chemical exchange with zeolites, either by

shaking with numerous batches of zeolite, or by using a long column packed with zeolite. $^7Li^+$ is more readily removed from zeolite than $^6Li^+$ but $^6Li^+$ is preferentially taken up by the zeolite. The ratio for Li increases or decreases (from 11·7) according to experimental conditions. The fractionation factor with Na zeolite is 1·022. Similar exchange reactions for ^{39}K and ^{41}K and for ^{14}N and ^{15}N give 10% change. The exchange for K isotopes was carried out with Na, K, and Ca zeolites, and for N isotopes with Na and H zeolites. For both these atoms the heavier isotope is more readily taken up by the zeolite. An equilibrium process is responsible for the fractionation. W. R. A.

Active aluminium obtained by high-temperature electrolysis. A. CHRÉTIEN and J. BISCH (Compt. rend., 1938, **207**, 237—239).—A fused 2 : 1 mol. mixture of $AlBr_3$ and KBr was electrolysed at 500° in an atm. of N_2 under pressure, using an Al anode and a Hg cathode (50 c.c.) in a steel bomb. The solubility of Al in Hg increases with temp. (20·4 g.-mols. of Al per 100 g.-mols. of Hg at 510°). A current of 2 amp. at 30 v. was employed. Active Al separates from the Hg on cooling. H. J. E.

Oxidation of carbon in electrolytes at normal temperature. H. THIELE (Trans. Faraday Soc., 1938, **34**, 1033—1039).—The behaviour of graphite electrodes, immersed in various types of electrolytes, has been investigated when a current is passed. The electrolytes have ranged from alkalis to conc. acids, and the graphite of the electrodes has been varied from cryst. graphite to amorphous C. In alkalis O_2 is evolved briskly at the anode; the anode is coloured brown and deposits the discoloration into the solution. Amorphous C, which is attacked to a greater extent than graphite, is oxidised to CO_2 and to humic acid. In N-H_3PO_4 no O_2 is evolved but a primary oxide is formed which, after a time, yields graphite and O_2. The primary oxide possesses oxidising properties, liberating free halogens from halides, and in contact with alkalis O_2 is evolved almost violently. Under similar conditions graphite in H_2SO_4 takes up more O_2 than in H_3PO_4 of equal concn. The behaviour in HNO_3, $HClO_3$, $HClO_4$, and HF resembles that of H_2SO_4, whilst HCl, HBr, HI, AcOH, $CH_2Cl{\cdot}CO_2H$, and chromic acids are similar to H_3PO_4. In conc. H_2SO_4 practically no O_2 is evolved; most of the O_2 enters spaces between crystal planes, causing the anode to swell and become lamellated. Cryst. graphite undergoes cleavage, amorphous C becomes swollen, and retort or arc C is split into fragments with crackling. For each concn. of all acids similar in behaviour to H_2SO_4, and for their salts, swelling takes place after a time above a crit. c.d. No swelling occurs for "phosphoric-like" acids. When anhyd. H_2SO_4 is used the swollen anode becomes a lustrous deep blue colour. The amount of O_2 bound in the anode has been determined and formation of graphitic salts is not supported (cf. Hofmann and Rüdorff, A., 1938, I, 531). Distension of graphite, as distinct from swelling, is considered. The properties of graphite oxide and graphitic acid are discussed. W. R. A.

Electrochemical interpretation of Wagner's theory of tarnishing reactions. T. P. HOAR and L. E. PRICE (Trans. Faraday Soc., 1938, **34**, 867—872).—Theoretical. The process of tarnishing a metallic surface, with the production of a compact film of oxide, sulphide, etc., is regarded as the action of a cell with the metal–film and the film–attacking substance interfaces as anode and cathode respectively; the film acts as both external circuit and electrolyte. Using this conception, an expression for the rate of tarnishing, similar to that obtained by Wagner (A., 1933, 564), is deduced. A similar expression for the more complicated case, where the conductivity of the tarnished film varies with the pressure of the attacking gas, is derived. The theory offers a logical explanation of tarnish-resistant metals and alloys. W. R. A.

Electrodeposition of silver from solutions of silver nitrate in presence of addition agents.—See B., 1938, 1057.

Dissolution of rhodium by alternating current electrolysis.—See B., 1938, 1052.

Nature of the primary process in photochemical reactions. G. K. ROLLEFSON (J. Physical Chem., 1938, **42**, 733—737).—A review. Predissociation is discussed from the viewpoint of the uncertainty principle, and examples illustrating various types of primary process are given. J. W. S.

Comparisons between photochemical processes in gases and solutions. R. G. DICKINSON (J. Physical Chem., 1938, **42**, 739—748).—A review. Fundamental differences between reactions in gases and in the liquid state are discussed, with particular reference to the increased possibility of recombination of the primary dissociation products when reaction occurs in the liquid phase. J. W. S.

Quantum yields in experimental photochemistry. F. DANIELS (J. Physical Chem., 1938, **42**, 713—732).—The quantum yields of about 120 reactions, under various conditions of temp. and λ, are tabulated. J. W. S.

Experimental technique in photochemistry. F. DANIELS (J. Physical Chem., 1938, **42**, 701—711).—Recent advances in technique are summarised, with particular reference to light sources, filters, and monochromators, measurement of radiation, reaction cells, microanalysis of reaction products, and measurement of absorption spectra. J. W. S.

Secondary processes in the photo-chlorination of carbon monoxide and hydrogen. H. S. TAYLOR (J. Physical Chem., 1938, **42**, 789—794).—A review. The mechanism of the photochemical reactions between CO and Cl_2 and H_2 and Cl_2 are discussed with particular reference to recent results of Bodenstein and his collaborators. J. W. S.

Secondary processes in the photo-decomposition of ammonia and hydrazine. H. S. TAYLOR (J. Physical Chem., 1938, **42**, 783—788).—A review. Various mechanisms suggested for the photo-decomp. of NH_3 and N_2H_4 are discussed critically. J. W. S.

Mechanism of aldehyde and ketone photolysis. P. A. LEIGHTON (J. Physical Chem., 1938, **42**, 749—761).—A review of the various types of

primary process and secondary reactions and of polymerisation processes encountered in the photochemical decomp. of aldehydes and ketones. J. W. S.

Hydrocarbon free radicals in photo-processes. H. S. TAYLOR (J. Physical Chem., 1938, **42**, 763—772).—A review. The primary and secondary processes and quantum yields in the photolysis of alkyl iodides and metal alkyls, the Hg-sensitised hydrogenation of unsaturated hydrocarbons, and the Hg-sensitised decomp. of saturated hydrocarbons, in each case with production of free hydrocarbon radicals, are discussed. J. W. S.

Photochemical primary process of ions in aqueous solution. A. FARKAS and L. FARKAS (Trans. Faraday Soc., 1938, **34**, 1113—1120).—Theoretical. The process occurring in the absorption of light is considered to be the transfer of an electron from the ion to the H_2O mol. in the hydration layer. The electron can then return to its initial state (no photochemical change), or can pass over to the final state (chemical reaction). In the reaction of negative ions the final state is reached by the transfer of the electron to a positive ion. The mechanism is formulated for I', SO_3'', and $Fe^{\cdot\cdot}$. E. S. H.

Separation of hydrogen isotopes in the photochemical liberation of hydrogen from aqueous solutions. A. FARKAS and L. FARKAS (Trans. Faraday Soc., 1938, **34**, 1120—1127).—Separation factors for solutions of NaI + HCl, Na_2SO_3, and $FeSO_4 + H_2SO_4$ in 15—78% D_2O are 3·7—6·5, 10·6, and 3·8—4·8, respectively. Separation is considered to occur in the photochemical process, H having about 4 times as great a probability of being formed as D. E. S. H.

Photochemical deamination of amino-acids in water. II. C. WEIZMANN, Y. HIRSHBERG, and E. BERGMANN (J. Amer. Chem. Soc., 1938, **60**, 1799—1801; cf. A., 1936, 1349).—The photochemical change, $NH_2{\cdot}CHR{\cdot}CO_2H \rightarrow OH{\cdot}CHR{\cdot}CO_2H$, in H_2O is faster for phenylalanine and alanylglycine than for alanine, but the concn. affects the numerical ratios. This change is the only possible biochemical method of hydrolysis of amino-acids. The quantum yield for glycine, alanine, and betaine is 0·1, 0·087, and 0·064, respectively. R. S. C.

Spectral sensitivity of photographic layers. J. EGGERT and M. BILTZ (Trans. Faraday Soc., 1938, **34**, 892—901).—The sensitivity of photographic AgBr layers has been measured as a function of λ; the AgI content, the state of ripening, and the sensitisation have been varied. Quant. relationships between AgBr and dye content, AgBr and light quanta absorbed, and AgBr and developed density have been established for a layer sensitised optimally for the green. The mechanism of the photographic process is considered. The sensitivity of AgBr is due to *Störstellen* in the crystal lattice. When energy is supplied, the *Störstellen* undergo photolysis with production of new *Störstellen* in the hitherto undisturbed AgBr lattice. At $\lambda\lambda$ >5000 A. the *Störstellen* alone determine the sensitivity of an unsensitised layer. From 5000 A. to shorter λ AgBr acts as an energy carrier. Sensitisers, such as AgI or dyes, act as energy carriers and give up absorbed light to the *Störstellen*. W. R. A.

Adsorption theory of photographic development. A. J. RABINOVITCH (Trans. Faraday Soc., 1938, **34**, 920—926).—The supersaturation and catalytic theories of development are reviewed and an adsorption theory is formulated, in which adsorption of the org. developers takes place on colloidal Ag particles forming the nuclei of the latent image and not on the surface of AgBr, as proposed by Sheppard (Phot. Korr., 1922, 76). Experimental evidence supports this theory. An apparatus by which the development of a single grain of a AgBr emulsion can be photographed is described. From an invisible nucleus, situated usually on the edge of the grain, darkening spreads in circular zones with the radius increasing linearly with the time of development, as predicted by the theory. The effects of changing the conditions of development are discussed. W. R. A.

New time phenomenon in photographic emulsions. F. WEIGERT (Trans. Faraday Soc., 1938, **34**, 927—930).—The production of photodichroism on an oblique film of AgCl–gelatin by the combined action of natural blue and red light is described. When plotted against the spectrum, the photodichroism was the more positive as the time interval between a blue and a red exposure was increased, but a dark interval following a red exposure had no appreciable effect. This is probably due to the production, by the blue light, of a sensitiser for red which slowly loses its activity. This phenomenon confirms the mechanisms of sensitising and auto-sensitising actions previously suggested (A., 1935, 311). W. R. A.

Generalisation of the theory of photodichroism. S. NIKITINE (Compt. rend., 1938, **207**, 331—333; cf. A., 1938, 1, 318). A. J. E. W.

Photographic sensitivity. LÜPPO-CRAMER (Trans. Faraday Soc., 1938, **34**, 930—935).—The contradictory opinions as to the photographic sensitivity of pure dry Ag halides are reviewed. Principally the sensitivity of ordinary photographic plates is due to the germs. With layers quite free from binding material the sensitivity decreases with increasing size of the grain, the smaller grain being more easily reduced by the developer. The reverse is true with AgBr–gelatin, as the protective action of the colloid is more effective with the small grains. Optically determinable light absorption cannot measure light-sensitivity. The latent image formed by *X*-ray irradiation of AgBr films is chiefly conc. on the grain surface, as is shown by the action of oxidising agents and desensitising dyes. Other reversible phenomena in photographic layers are discussed. W. R. A.

Action of various elements and compounds on photographic plates. II. S. AOYAMA and T. FUKUROI (Sci. Rep. Tôhoku, 1938, **26**, 641—676; cf. A., 1935, 1087).—The action of Mg on photographic plates increased linearly with exposure time; it decreases slowly after the specimens have been polished. Glass exerts a greater screening

effect than quartz; the effect of other surfaces was: $Cu_2O>Cu>CuO$; $Fe>Fe_2O_3$; $NiO>Ni$. Tests at various distances in air, N_2, and H_2 show that deactivation $\propto$ (pressure)$^{\frac{1}{2}}$. The rate of diffusion of activated particles on photographic plates approx. $\propto$ (time)$^{\frac{1}{2}}$; the rate of diffusion rises with temp. Diat. gases and H_2O vapour are strongly activated whereas monat. gases are not. C. M. A.

Fluorescence of sodium salicylate in photographic photometry. R. MONTAGNE and L. HERMAN (Sci. Ind. phot., 1936, [ii], **7**, 225—232; Chem. Zentr., 1936, ii, 2277).—The γ of plates sensitised with Na salicylate (I) (cf. Tien Kiu, B., 1938, 188) is nearly const. for $\lambda\lambda$ $<$700 A. Duclaux-Jeantet gelatin-free plates are more sensitive only for low intensities. Reliable data for the energy yield of fluorescent (I), for use in accurate measurements, are not available. A. J. E. W.

Action of ultra-violet rays on mercury fulminate. A. BOROCCO (Compt. rend., 1938, **207**, 166—168).—The change of colour of Hg fulminate (I) on exposure to ultra-violet radiation depends on the duration of exposure and on the intensity of the radiation. Measurements of ρ and X-ray spectrum and microscopical examination show that the structure of (I) has not been affected. Exposure of (I) in vac., however, indicates partial decomp. to Hg, CO_2, and N_2. The total effect of exposure to ultra-violet radiation is thus analogous to that produced by heating. W. R. A.

Statistical interpretation of reactions between solids at high temperatures. T. PECZALSKI (Compt. rend., 1938, **207**, 45—46).—A theory is given to explain previous experimental results (A., 1938, I, 450). W. R. A.

Geometrical factors in reactions involving solids. J. D. BERNAL (Trans. Faraday Soc., 1938, **34**, 834—839).—Consideration of X-ray analysis data on a variety of reactions involving solids shows that in all such reactions there is a marked tendency to preserve crystal orientations and at. positions as unchanged as possible. W. R. A.

Rôle of supersaturation and the limiting stage in topochemical reactions. S. Z. ROGINSKY (Trans. Faraday Soc., 1938, **34**, 959—969).—In reactions involving solids sometimes the chemical and sometimes the crystallisation processes determine the course of the reaction; the influence of supersaturation of the reaction (distance from equilibrium) on which of these processes will predominate is discussed. W. R. A.

Preparation of anhydrous acetates.—See A., 1938, II, 390.

Potassium nitrilosulphonate. H. SISLER and L. F. AUDRIETH (J. Amer. Chem. Soc., 1938, **60**, 1947—1948).—Max. yields are obtained when the ratio $KHSO_3:KNO_2$ is $<4:1$, and when hot solutions are used. Hydrolysis has been studied at 25—100°; the consecutive reactions (1) $N(SO_3)_3''' + H_2O \rightarrow NH(SO_3)_2'' + H^{\cdot} + SO_4''$, (2) $NH(SO_3)_2'' + H_2O \rightarrow NH_2{\cdot}SO_3' + H^{\cdot} + SO_4''$ occur. E. S. H.

Chemical changes of fused alkali nitrates at temperatures of 460—600°. K. LESCHEWSKI and W. DEGENHARD (Z. anorg. Chem., 1938, **239**, 17—26).—The decomp. of $NaNO_3$, KNO_3, and mixtures of these in presence of Fe, Al, duralumin, and lautal at 460—600° has been studied. As a rule the % of nitrite or of alkali oxide formed is greatest with $NaNO_3$ and least with KNO_3 and is increased by the presence of the metals. F. J. G.

Complex salts of the alkali and alkaline-earth metals. P. PFEIFFER and W. CHRISTELEIT (*Z.* anorg. Chem., 1938, **239**, 133—144).—*o-Phenanthroline perchlorate*, $C_{12}H_8N_2HClO_4,2H_2O$, m.p. 193—194·5° and *mercurichloride*, $C_{12}H_8N_2HHgCl_3$, *bis-dipyridyl Pb perchlorate*, $[Pb(C_{10}H_8N_2)_2](ClO_4)_2$, and the following complex *salts* containing *o*-phenanthroline are described: $[Li(C_{12}H_8N_2)]ClO_4$; $[Na(C_{12}H_8N_2)_2]ClO_4,3H_2O$; $[Ag(C_{12}H_8N_2)_2]NO_3,H_2O$; $[Tl(C_{12}H_8N_2)_2]NO_3,2{\cdot}5H_2O$; $[Ca(C_{12}H_8N_2)_4](ClO_4)_2,3H_2O$; $Ca(ClO_4)_2,6C_{12}H_8N_2,4H_2O$; $[Sr(C_{12}H_8N_2)_4](ClO_4)_2,8H_2O$; $[Ba(C_{12}H_8N_2)_4](ClO_4)_2,8H_2O$; $[Pb(C_{12}H_8N_2)_4](ClO_4)_2$; $[Hg(C_{12}H_8N_2)_3](ClO_4)_2$; and $[Bi(C_{12}H_8N_2)_3](ClO_4)_3$. The co-ordination nos. 8 for Ca, Sr, Ba, and 6 for Hg, are noteworthy. F. J. G.

Dehydration of salt hydrates. J. COLVIN and J. HUME (Trans. Faraday Soc., 1938, **34**, 969—976).—In dehydration of salt hydrates two factors are involved: (1) retardation of the reaction rate by H_2O vapour is greater when the new solid phase is amorphous than when it is cryst., and (2) formation of a cryst. new phase is catalysed by H_2O vapour. The conditions under which $CuSO_4,3H_2O$ is formed in the dehydration of $CuSO_4,5H_2O$ are discussed. The results of Topley and Smith (A., 1935, 588) and of Volmer and Seydell (A., 1937, I, 468) on the dehydration of $MnC_2O_4,2H_2O$ are discussed. W. R. A.

Active substances. XXXI. Heat content and lattice condition of different active varieties of CuO and heat of formation of $Cu(OH)_2$. R. FRICKE, E. GWINNER, and C. FEICHTNER (Ber., 1938, **71**, [*B*], 1744—1754).—The prep. of various forms of CuO is described. Measurements of the heat of dissolution of CuO pptd. at 35° and then heated at various temp. show a max. difference in heat content of 1·45 kg.-cal. (difference between specimens preheated at 80° and 600°, respectively). Small particle size and admixture with amorphous material are the cause of the increase in heat content of material preheated at only a low temp. Particle sizes are calc. for monoclinic CuO by the method of von Laue and Brill. The % of admixed amorphous material is directly deduced from measurements of the interference intensities since larger, irregular lattice disturbances of the cryst. portion, judged by the course of the intensities with increasing angle of reflexion, are not present. Lattice extensions cannot be detected in varieties of CuO rich in energy. Hahn's emanation method gives particle sizes for preps. poorer in energy which agree in order of magnitude with those estimated röntgenographically; these indicate a loose, secondary structure for the oxides

poorer in energy. From the heats of dissolution of cryst. $Cu(OH)_2$, determined under the conditions used for CuO, it is shown by the approximations of Nernst and Ulich that cryst. $Cu(OH)_2$ at room temp. is in equilibrium only with those varieties of CuO which are richest in energy. H. W.

Copper salts of imidosulphonic acid. (MLLE.) L. CHAUMETON (Compt. rend., 1938, **207**, 162—163).—In distinction to the action of $NH_2{\cdot}SO_3H$ on Ag and Hg to give derivatives with the metal attached to the N atom (A., 1936, 944) $NH(SO_3H)_2$ produces with Cu simple salts and mixed salts. Starting with the Ba salt, $NH(SO_3)_2Ba,2H_2O$, and a saturated solution of $CuSO_4$, pale blue crystals of $NH(SO_3)_2Cu,5H_2O$ (I) were obtained. They are readily hydrolysed and on drying lose 2 H_2O. Addition of EtOH to the aq. NH_3 solution of (I) yields the violet *salt*, $NH(SO_3)_2[Cu(NH_3)_4],H_2O$. When $CuSO_4$ or $Cu(NO_3)_2$ is added to tribarium imidosulphonate, $Ba[N(SO_3)_2Ba]_2,5H_2O$, long, deep blue needles of $N_2(SO_3)_4Ba_2Cu,xH_2O$ (II) are obtained. (II) is insol. in H_2O, org. solvents, and aq. NH_3, and has birefringent crystals. The magnetic susceptibilities of (I), (II), $(NH_2{\cdot}SO_3)_2Cu,2H_2O$, $NH(SO_3)_2Cu,5$(and 2)H_2O, and $(NH_2{\cdot}SO_3)_2[Cu(NH_3)_4],5H_2O$ have been measured at 20° by a Curie–Cheneveau balance. The susceptibility of Cu has been deduced and is approx. 1500 for all compounds except (II), for which it is 1712. This indicates that in (II) the Cu atoms are not attached to the SO_3 groups. The structure $Cu[N(SO_3)_2Ba]_2,6H_2O$ is assigned to (II). W. R. A.

Pharmaceutically important arsenic compounds. V. Silver and thallium arsenites. K. BRAND and E. ROSENKRANZ (Pharm. Zentr., 1938, **79**, 537—542).—The reaction between Ag_3AsO_3 and EtI affords only $As(OEt)_3$ and no $O{:}AsEt(OEt)_2$. *Tl meta-arsenite*, $TlAsO_2$, is described. F. J. G.

Mercuri-iodides. F. GALLAIS (Ann. Chim., 1938, [xi], **10**, 117—193).—The formation of complex salts from HgI_2 in solution and in the solid state, and their magnetic properties, have been studied. At room temp. the curves for conductometric titration of $HgCl_2$ with alkali iodides, and the magnetic rotations of mixtures of $HgCl_2$ with BaI_2 and with HI, indicate that only one complex ion, viz., HgI_4'', exists and that it is somewhat dissociated in H_2O but not in 20% EtOH. The vals. of Λ for solutions of $HgI_2 + 2KI$ and $HgI_2 + 2HI$ agree respectively with those for tri-ionic salts and for dibasic acids. Attempts to prepare an ester of H_2HgI_4 were unsuccessful. From measurements of magnetic rotation for conc. solutions of $Hg(NO_3)_2 + KI$ the const. $[HgI_2][I']^2/[HgI_4'']$ is $\sim 2{\cdot}5 \times 10^{-5}$ at 20°, whereas at 99° the complex ion is HgI_3' and the const. $[HgI_2][I']/[HgI_3']$ is $\sim 5{\cdot}6 \times 10^{-2}$. Solutions of the salt KI,HgI_2,H_2O give a different Raman spectrum from those of K_2HgI_4; their conductivity agrees with that for a di-ionic salt, and the H_2O is relatively firmly bound, so that this salt is to be regarded as $K[HgI_3(H_2O)]$. Ag_2HgI_4 and $Cu^I_2HgI_4$ have $\chi \times 10^6 = -0{\cdot}19$ and $-0{\cdot}26$, respectively. Attempts to prepare $AgHgI_3$ and $CuHgI_3$ were unsuccessful. The action of boiling aq. NH_3 on Cu_2HgI_4 yields Hg and $[Cu(NH_3)_4][HgI_4]$ whilst double decomp. between K_2HgI_4 and $[Cu(NH_3)_4]SO_4$ affords the *hydrate* $[Cu(NH_3)_4][HgI_4],15H_2O$. Attempts to prepare the salt $2HgI_2,CuI_2,4NH_3$ (Jörgensen, J. pr. Chem., 1870, [ii], 2, 347) were unsuccessful. *Tl mercuri-tetraiodide*, Tl_2HgI_4, has been obtained as a yellow ppt., $\chi \times 10^6 = -0{\cdot}24$, and its individuality established by means of *X*-rays. Conductometric titration of K_2HgI_4 with Tl_2SO_4 indicates that it is the only Tl^I mercuri-iodide. Dil. solutions of Na_2HgI_4, K_2HgI_4, and $K[HgI_3(H_2O)]$ are diamagnetic. F. J. G.

Mercury-sensitivity of aluminium. H. LICHTENBERG (Z. anorg. Chem., 1938, **239**, 189—196).—The gain in wt. on exposure to air of Al activated by Hg $\propto t^{\frac{1}{2}}$. Impurities decrease the rate of oxidation, and it is completely inhibited by 0·2% Cu, 1% Fe, or 5% Si. Both O_2 and H_2O are necessary for the reaction, and the product is γ-Al_2O_3, with adsorbed H_2O. F. J. G.

NH_4AlF_4. E. THILO (Naturwiss., 1938, **26**, 529).—The thermal decomp. of $(NH_4)_3AlF_6$ takes place in stages. If the compound is heated in dry N_2 at 350° the reaction $(NH_4)_3AlF_6 \rightarrow NH_4AlF_4 + 2NH_4F$ occurs. Above 350° pure AlF_3 is obtained in complete absence of H_2O. NH_4AlF_4 is isomorphous with $TlAlF_4$, the unit cell having a 3·59, c 6·34±0·01 A. A. J. M.

Preparation and crystal structure of europium sulphide, EuS, and fluoride, EuF_2. G. BECK and W. NOWACKI (Naturwiss., 1938, **26**, 495—496).—EuF_2, d 6·495, was prepared from EuF_3 by reduction in H_2 at a red heat. Impure EuS was obtained by heating Eu_2O_3 in a current of H_2S. The violet product contained some oxysulphide. By heating $Eu_2(SO_4)_3$ in a current of H_2S, a brownish-violet sulphide was obtained. It is pyrophoric, insol. in H_2O, but readily sol. in very dil. acids. Attempts to make EuO were unsuccessful. EuS has the NaCl type of crystal structure with a 5·957±0·002 A. The ionic radius of Eu^{++} is 1·24 A. A powder photograph of EuF_2 with NaCl as standard gave a cubic structure for EuF_2 with a 5·796±0·006 A. There are 4 mols. in the unit cell. The probable space-groups are T_h^3—$Fm3$, O^3—$F43$, and O_h^5—$Fm3m$. EuF_2 has the fluorite structure, a result confirmed by determination of the relative intensities of the *X*-ray spots. Comparison with the lattice consts. of BaF_2 and SrF_2 shows that the dimensions of the EuF_2 crystal are nearer those of SrF_2 than BaF_2. A. J. M.

Thermal decomposition of some gallium salts and structure of the resulting oxide. G. CENTOLA (Congr. int. Quim. pura apl., 1934, **9**, III, 230—238; Chem. Zentr., 1936, ii, 2322).—The following are formed successively on heating $Ga_2(C_2O_4)_3,4H_2O$: $Ga_2(C_2O_4)_3,2H_2O$ (140—150°), $Ga_2(C_2O_4)_3$ (166—180°), and Ga_2O_3 (195—200°). $Ga(OH)(OAc)_2$ gives GaO(OAc) (140—150°) and Ga_2O_3. In each case the Ga_2O_3 formed gives an amorphous *X*-ray diagram, β-Ga_2O_3 being formed on heating to >480—600°. Decomp. of $Ga(OH)_3$ or $Ga(NO_3)_3$ gives α-Ga_2O_3. A. J. E. W.

[**Pentacarbon dioxide.**] A. KLEMENC (Ber., 1938, **71**, [*B*], 1625—1626; cf. A., 1937, I, 575).—A reply to Diels (A., 1938, I, 410). H. W.

Reactions of dicarbon gas. A. KLEMENC and G. WAGNER (Z. anorg. Chem., 1938, **239**, 1—13).—The reactions of C_2, formed in the decomp. of C_3O_2 (cf. A., 1934, 1314), with O_2 and H_2 at 200° have been studied. Reasons are given for the belief that they are reactions of C_2 and not of C_3O_2. With O_2, CO and CO_2 and at the same time two solid *C oxides*, C_3O_4 and C_3O_6, are formed. These are colourless or faintly yellow and stable to alkali. At 300° they decompose to CO and CO_2. It is suggested that C_3O_4 and C_3O_6 result from addition of O_2 to C_3O_2, whilst C_2 affords at first C_2O_2 which may then decompose to 2CO or to $C + CO_2$, followed by $C + O_2 = CO_2$. With H_2 the products are C_2H_2 and higher hydrocarbons. Some observations on the thermal decomp. of C_3O_2 and on the photochemical polymerisation of C_2 to red solid C are recorded. F. J. G.

Influence of keto- and keten groups, adsorbed molecules and ions on the mechanism of carbon oxidation. V. SIHVONEN (Trans. Faraday Soc., 1938, **34**, 1062—1074).—Theories concerning the mechanism of the breakdown of the C lattice are based on extensive experimental evidence on the influence of keto- and keten groups, and of adsorbed mols. The mechanism of C oxidation, the reduction of CO_2, the adsorption of O_2, the effect of H_2O, and the anodic oxidation of C both in the electrolytes and in the gas phase are considered. W. R. A.

Surface reaction of graphite with oxygen, carbon dioxide, and water vapour at low pressures. L. MEYER (Trans. Faraday Soc., 1938, **34**, 1056—1061).—An apparatus for the investigation of the surface reactions of graphite with oxidising gases is described and the requirements necessary for the investigation of the true primary surface reaction are indicated. The reaction with O_2 shows two different types, viz., a low-temp. (up to 1500° K.) reaction of the first order, characterised by dissolution of O_2 in the graphite according to Henry's law, and a high-temp. (>1800° K.) reaction of zero order. The surface reaction with CO_2 is also of zero order. A description of the experiment with H_2O vapour is given; the reaction is of zero order as found by Sihvonen, no CO_2 being formed as primary product. The large difference in the abs. rate of formation of CO is attributed to differences in the structure or purity of the graphite. W. R. A.

Formation of salts from graphite by strong acids. U. HOFMANN and W. RÜDORFF (Trans. Faraday Soc., 1938, **34**, 1017—1021).—Graphite salts of $HClO_4$, H_2SeO_4, HNO_3, H_3PO_4, $H_4P_2O_7$, and H_3AsO_4, analogous to the compound formed between graphite and H_2SO_4, have been prepared. They are stable only in the presence of their parent acid (conc.) and are decomposed by H_2O (even by atm. H_2O). *X*-Ray examination of these salts shows that the hexagon structure of graphite persists. The acid is absorbed into the graphite lattice, one acid mol. for 8 C. The compounds, which are formed only in the presence of an oxidising agent, can be reduced by a reducing agent sol. in the appropriate conc. acid. Data on oxidation and reduction indicate that, with H_2SO_4, a graphite H sulphate, $C_{24}HSO_4$, is formed; and similarly with other acids. Undissociated acid mols., as well as anions, become absorbed between lattice layer planes; it is suggested that for 24 C two mols. and one anion of acid are taken up. Both formation and reduction of salts take place in stages of definite structure. The stabilities of the salts are: perchlorate and H sulphate > selenate > nitrate > phosphate and pyrophosphate > arsenate. The electrochemical behaviour of the salts, their reversible formation, their interconvertibility by anionic exchange, and the *X*-ray data favour the view that they are salts, not esters, of graphite. W. R. A.

Cold combustion of carbon monoxide by transformation into ammonium carbonate using ammoniacal solutions of copper salts. K. LESCHEWSKI, H. MÖLLER, and B. STEINMANN (Z. anorg. Chem., 1938, **239**, 180—188; cf. A., 1935, 1332; 1938, I, 262).—CO is not oxidised by Cu^{II} in absence of NH_3, whilst accumulation of $(NH_4)_2CO_3$ retards the absorption of CO. After a time the absorption of CO mixed with O_2 ceases when all the Cu^{I} is used, but treatment with CO alone regenerates Cu^{I} and restores the absorptive power of the solution. The process can be made continuous, with separation of solid $(NH_4)_2CO_3$, by using alternately CO mixed with O_2 and CO alone. F. J. G.

Silicon nitride. A. G. NASINI and A. CAVALLINI (Congr. int. Quim. pura apl., 1934, **9**, III, 280—293; Chem. Zentr., 1936, ii, 2320).—SiO_2 is converted into Si_3N_4 without formation of intermediate products by treatment with N_2 at 1300—1380°. The reactions (at 900—1300°) of Si_3N_4 with a no. of metallic oxides have been studied; they are regarded as involving O_2: $Si_3N_4 + 5O_2 = 3SiO_2 + 4NO + 349{\cdot}4$ kg.-cal. A. J. E. W.

Affinity. LXXXIV. Zirconium phosphides. E. F. STROTZER and W. BILTZ [with K. MEISEL] (Z. anorg. Chem., 1938, **239**, 216—224).—The existence of ZrP_2 (cf. A., 1908, ii, 597) has been confirmed. It is the highest Zr phosphide, and is stable to air, Br, and most acids, but is completely dissolved by hot conc. H_2SO_4. A *monophosphide*, ZrP, is indicated by tensimeter curves and *X*-ray photographs, and the latter also indicate the existence of a *subphosphide*. Data for ρ and mol. vol. of Zr–P preps. are recorded. F. J. G.

Preparation of pure metals of the titanium group by thermal decomposition of their iodides. IV. Appearance of lower zirconium iodides in the preparation of ductile zirconium. J. D. FAST (Z. anorg. Chem., 1938, **239**, 145—154).—When ZrI_4 is heated with Zr *lower iodides*, which decompose H_2O with evolution of H_2, are formed. The effects of this reaction on the course of the prep. of Zr by decomp. of ZrI_4 vapour at a glowing filament under various conditions have been investigated, and from the results it is concluded that ZrI_4 and Zr afford ZrI_3 at 400° and ZrI_2 at 560°, that ZrI_3 partly decomposes to ZrI_2 and ZeI_4 above 310°, and that ZrI_2 partly decomposes to Zr and ZrI_4 above 430°. F. J. G.

Basic zirconium sulphate obtained by hydrolysis of the normal sulphates. (MLLE.) M. FALINSKI (Compt. rend., 1938, **206**, 1479—1480).—A study of the system ZrO_2–SO_3–H_2O by the residue

method shows that the salt described by Hauser (A., 1910, ii, 872) is $7ZrO_2,5SO_3,nH_2O$. Analysis of the solid phases gives $n = 29{\cdot}5 \pm 0{\cdot}5$. A. J. E. W.

Lead oxides. A. BARONI (Gazzetta, 1938, **68**, 387—393).—*X*-Ray and magnetic investigations show that the supposed Pb_2O of various investigators is a mixture of Pb and of tetragonal PbO. *X*-Ray examination of the products of the thermal decomp. of PbO_2, both at atm. pressure and in vac., indicates the existence of only Pb_2O_3 and Pb_3O_4. No evidence for the existence of black Pb_3O_4 or of Pb_7O_{11} was obtained, and these are probably additive products of Pb_2O_3 with O. In the action of O_2 on PbO pressure (5—200 atm.) has no influence on the products formed, which are identical with those obtained by the decomp. of PbO_2. Magnetic measurements for the system PbO–O confirm this. O. J. W.

Nitrosyl fluoborate, its preparation, properties, and use for fluorination. S. A. VOZNESENSKI and P. P. KURSKI (J. Gen. Chem. Russ., 1938, **8**, 524—528).—NO_2 and conc. aq. HBF_4 yield $NOBF_4$. NH_2Ph,HCl in EtOH and $NOBF_4$ give $PhN_2{\cdot}BF_4$ in 90% yield. R. T.

α- and β-Monohydrates of molybdic anhydride. V. AUGER (Compt. rend., 1938, **207**, 164—166).—The prep. and properties of the α- and β-monohydrates of MoO_3 are discussed and the results of Rosenheim and Davidson (A., 1904, ii, 128) are criticised. The β-monohydrate is actually MoO_3 containing adsorbed H_2O. W. R. A.

Preparation and analysis of aqueous hypobromous acid. E. A. SCHILOV and N. P. KANJAEV (J. Gen. Chem. Russ., 1938, **8**, 445—447).—0·01—0·05M-Br is shaken with excess of Ag_3PO_4; the solution, when distilled in vac. at 25—30° in absence of light, yields pure aq. HOBr. Sensitive methods of detecting Br′ and BrO_3' in presence of HOBr are described. R. T.

Reduction of potassium permanganate by oxalic acid in aqueous solution. J. A. MULLER and (MLLE.) E. PEYTRAL (Bull. Soc. chim., 1938, [v], **5**, 1168—1171).—If 2 mols. of $KMnO_4$ and 3 mols. of $H_2C_2O_4$ are allowed to interact, $(MnO_2)_9,2K_2O,nH_2O$ is formed. After treatment with conc. HNO_3 and heating to 110° $Mn_9O_{17},4—5H_2O$ is formed, which, when heated to 350—400°, loses H_2O to form Mn_9O_{14}. C. R. H.

Preparation of a stable hydrate of manganese dioxide in dry air at room temperature. J. A. MULLER (Bull. Soc. chim., 1938, [v], **5**, 1166—1168).—If $KMnO_4$ is reduced, in presence of conc. HNO_3, by $H_2C_2O_4$ in an amount insufficient for complete reduction, the ppt., after drying at room temp., corresponds with $(MnO_2)_2,H_2O$. C. R. H.

Active substances. XXX. Chemical specificity of different forms, richer in energy, of one on the same type of crystal. I. Different forms, rich in energy, of α-Fe_2O_3. R. FRICKE, F. BLASCHKE, and C. SCHMITT (Ber., 1938, **71**, [*B*], 1738—1743).—Different, active preps. of α-Fe_2O_3 are immersed in solutions of K_3PO_4 until adsorptive equilibrium is attained and the adsorbed KOH and H_3PO_4 are measured. The transition from α-FeO_2H to the very irregularly distorted lattice of α-Fe_2O_3 causes an immediate increase in the ratio of adsorbed KOH to adsorbed H_3PO_4, which diminishes greatly with lessened distortion of the oxide (with increasing temp. of preheating). It thus appears that α-Fe_2O_3 with very irregular lattice distortion has much stronger acidic in relationship to its basic properties than an α-Fe_2O_3 with mainly ordered crystal lattice. According to conditions with respect to energy content, a chemical compound can exhibit different chemical properties. H. W.

Hydroxides and oxide hydrates. LI. Dependence of the chemical properties of polymorphous compounds on the type of crystal. II. Ferric hydroxides. R. FRICKE, F. BLASCHKE, and C. SCHMITT (Ber., 1938, **71**, [*B*], 1731—1737).—From equally conc. solutions of K_3PO_4, equal amounts of different, finely-divided preps. of α-FeO_2H and γ-FeO_2H adsorb KOH and H_3PO_4 in such a manner that the quotient of the adsorbed amounts of the two types of ion is nearly identical for both types of crystal. The basic and acidic properties of the two crystal types are therefore closely similar. According to these results and to measurements of p_H γ-FeO_2H is rather more strongly acidic than α-FeO_2H. In their amphoteric behaviour the two cryst. modifications of FeO_2H differ less from one another than do the two cryst. types of α-AlO_2H (Fricke *et al.*, A., 1937, I, 19). H. W.

Magnetic contribution of the constituents of ferric hydroxide formed in alkaline media. R. CHEVALLIER and (MLLE.) S. MATHIEU (Compt. rend., 1938, **207**, 58—61).—$Fe(OH)_3$ formed in alkaline media contains goethite, α-Fe_2O_3,H_2O (I), which can be isolated by HNO_3, and a HNO_3-sol. $Fe(OH)_3$ (II). The individual contributions of (I) and (II) are considered. The susceptibility of (I) is small, whilst that of (II) is high and increases with time. The high val. for (II) may arise from the presence of some ferromagnetic Fe_2O_3 formed during the reaction; this theory has not yet been proved but evidence of the heterogeneity of (II) is cited in its favour. W. R. A.

Higher oxygen compounds of nickel. B. A. PETROV and B. ORMONT (J. Gen. Chem. Russ., 1938, **8**, 563—571).—Repetition of Goralevitsch's work (A., 1930, 1141; 1931, 324; 1932, 585) does not lead to production of Ni^{VI} or Ni^{VIII} oxides, but only to NiO, Ni_2O_3, and NiO_2. NiO_2 was also prepared by anodic oxidation of Ni. R. T.

Artificial radioactivity as a test for minute traces of elements. G. T. SEABORG and J. J. LIVINGOOD (J. Amer. Chem. Soc., 1938, **60**, 1784—1786).—Small amounts of impurities can be detected by means of their characteristic half-lives after the substance containing the impurities has been rendered artificially radioactive. With the aid of chemical separation, 6 p.p.m. of Ga were detected in Fe. E. S. H.

Review of the application of microscopical study to metallurgical problems. G. M. SCHWARTZ (Econ. Geol., 1938, **33**, 440—453).—The

val. of methods of microscopical analysis, particularly the study of polished surfaces of ores, is illustrated. L. S. T.

Qualitative analysis by the semi-micro-method. G. W. SMITH (J. Chem. Educ., 1938, **15**, 324—329).—Apparatus and methods are briefly described. A comparison of results obtained by macro- and semi-micro-methods shows the latter to be satisfactory. L. S. T.

Quantitative mineralogical analysis of dusts. J. H. HELLMERS and H. UDLUFT (Zeiss-Nachr., 1936, **2**, 1—10; Chem. Zentr., 1936, ii, 2178).—A method of analysing dusts, employing an immersion method of determining n for the particles in conjunction with a polarising microscope, is described. A. J. E. W.

Report of [A.O.C.S.] Committee on Indicators. J. L. MAYFIELD (Oil & Soap, 1938, **15**, 206—207).—Thymolphthalein and Me-blue are considered undesirable; thymol-blue is better, but the colour change is not adequate in all cases. All three indicators show an unsatisfactory lack of uniformity between different batches of the dyes. An aniline-blue (G. Grubler) gives a sharp, distinct red–blue change and the results obtained with it up to almost 30% free fatty acids were identical with those obtained with phenolphthalein. E. L.

6 : 7-Dimethoxy*iso*quinoline-1-carboxylic acid as a fluorescence indicator. L. SZEBELLÉDY and J. JÓNÁS (Z. anal. Chem., 1938, **113**, 326—334).—The oxidation ($KMnO_4$) product of papaverine having the properties of a fluorescent indicator is shown to be 6 : 7-dimethyl*iso*quinoline-1-carboxylic acid. The data tabulated for the limits of visibility of the fluorescence of the indicator show that the presence of the commoner ions and cations has little or no effect. The colour change interval of the fluorescence ranges from p_H 9·5 (yellow) to p_H 11·0 (blue). The indicator is suitable for the titration of strong and weak acids and strong bases in coloured solutions. Data for the titration of 0·1N- and N-NaOH with AcOH alone (compared with phenolphthalein) and in presence of Columbia-brown R, tartrazine XX, and methylene-blue are recorded. Anhyd. glycerol is the most suitable solvent for the prep. of a solution (0·1%) of the indicator. For colourless solutions 0·2 c.c. of this solution, after dilution with an equal vol. of EtOH, is recommended for each 100 c.c. to be titrated; for coloured solutions, 1 c.c. is preferable. L. S. T.

Orcinolaurin as a fluorescence indicator. J. JÓNÁS and L. SZEBELLÉDY (Z. anal. Chem., 1938, **113**, 422—428).—Orcinolaurin can be used as a fluorescence indicator for titration of strong acids and bases in deeply coloured solutions by ordinary light. Its greenish fluorescence develops at p_H between 6·5 and 8·0. The usual cations (except $Fe^{\cdots}$) and anions have only slight effects on the fluorescence. J. W. S.

Anthocyans as indicators in neutralisation analysis. V. H. MATULA and C. B. MACEK (Chem. Obzor, 1936, **11**, 83—84; Chem. Zentr., 1936, ii, 2758).—The anthocyan prepared from the flowers of *Althæa rosea* (A., 1930, 1143) is rose-red at p_H 1—4, sepia-brown at neutralisation point, and green at p_H 11; it possesses the advantage of changing colour near to the neutralisation point. The colouring matter of red cabbage is also an indicator. A. H. C.

Quantitative analysis of mixtures of strong and weak acids, buffer and neutral salts.—See B., 1938, 1082.

Determination of hydrogen in steels.—See B., 1938, 1048.

Determination of chlorine by Mohr's method in presence of manganese. I. C. RITSEMA (Pharm. Weekblad, 1935, **75**, 1017—1018).—Mn interferes with the end-point in the titrimetric determination of Cl in drinking-H_2O, using Ag_2CrO_4 as indicator. It may be removed by shaking the sample with MgO and filtering off the ppt. before titration. MnO reacts with Ag_2CrO_4 to give Ag, CrO_4'', $Mn^{\cdots}$, and MnO_2. S. C.

Micro-analytical determination of bromine.—See A., 1938, III, 862.

Determination of iodine and potassium iodide in tincture of iodine.—See B., 1938, 1097.

Titration of small quantities of fluorides with thorium nitrate. I. Effect of changes in amount of indicator and acidity. II. Effects of chlorides and perchlorates. D. DAHLE, R. U. BONNAR, and H. J. WICHMANN (J. Assoc. Off. Agric. Chem., 1938, **21**, 459—467, 468—474).—I. Rowley and Churchill's procedure (A., 1938, I, 95) is modified so as to apply to small amounts of F by titrating a blank with NaF to an exact colour match with the experimental sample. The relation between colour developed, [F], and p_H is worked out in detail; greatest accuracy and sensitivity are obtained at p_H 2·75.

II. In presence of Cl′ and ClO_4' the vals. obtained are too high. Neutralisation of the distillate is to be avoided. A procedure for titrating without neutralisation and means of avoiding high acidity in the distillate are presented. E. C. S.

Rapid determination of fluorine in apatites. See B., 1938, 1033.

Determination of sulphur by means of oxidising alkali melts. A. L. BERNOULLI and H. STAUFFER (Z. anal. Chem., 1938, **113**, 340—342).—0·1—0·2 g. of the sample is covered with 2 g. of $KClO_3$, 5 g. of KOH, and 2—5 c.c. of H_2O in a Ni crucible. A smaller Ni crucible is inverted over the mixture, and both crucibles are heated to redness from top and bottom in a regulated manner. After treatment of crucibles and the fused mass with hot H_2O, the solution is weakly acidified with conc. HCl, and filtered. The SO_4'' is then pptd. as usual. For org. compounds containing S, the error is $\pm$0·3%, and with care no explosion occurs. Advantages of the method are its simplicity and the avoidance of ions, such as NO_3', strongly adsorbed by $BaSO_4$. L. S. T.

Determination of pyritic sulphur in coal.—See B., 1938, 1002.

Rapid potentiometric method for determination of sulphate. B. E. CHRISTENSEN, H. WYMORE,

and V. H. CHELDELIN (Ind. Eng. Chem. [Anal.], 1938, **10**, 413—414).—SO_4'' (0·05—0·25N) can be determined in 25—60% aq. MeOH, containing >1 mg. of $K_2S_2O_3$ in 25 c.c., by electrometric titration with $BaCl_2$. E. S. H.

Errors in the use of standard sodium thiosulphate solutions containing borax as preservative. C. W. JORDAN (Amer. J. Pharm., 1938, **110**, 316—321).—The use of borax and other substances for preserving standard aq. $Na_2S_2O_3$ is discussed. Erroneous results are obtained when alkaline preservatives (NaOH, Na_2CO_3, borax, etc.) are used; the error is up to 50% in McIlhiney's Br method of determining unsaturated linkings (A., 1903, ii, 340). F. O. H.

Semi-micro-determination of nitrogen in coke.—See B., 1938, 1003.

Aspiration method in determining ammonia and other volatile gases. L. A. SARVER (Ind. Eng. Chem. [Anal.], 1938, **10**, 415).—Relative advantages of aspiration and distillation are discussed. E. S. H.

Colorimetric determination of ammonia with phenol and hypochlorite. Application in Fuchs' carcinoma reaction. K. HINSBERG and K. MUCKE (Biochem. Z., 1938, **297**, 332—335).—For the photometric determination of NH_3 (*e.g.*, after heating with H_2SO_4 as in the Kjeldahl method) the procedure depending on the colour produced with phenol and NaOCl (cf. Van Slyke and Hiller, A., 1934, 94) is superior to the Nessler method, which, however, is to be preferred in applying Fuchs' test (Z. ges. exp. Med., 1936, **98**, 70). W. McC.

Micro-determination of ammonium. Micro-alkalimetric studies. III. J. MIKA (Mitt. berg.-hüttenmänn. Abt. Palatin-Joseph-Univ., 1935, **7**, 92—110; Chem. Zentr., 1936, ii, 2180).—The sample is distilled to dryness with aq. NaOH in a current of air, the NH_3 being absorbed in H_3BO_3 and titrated. The apparatus and technique are described. An average negative error of $>0·6$% is claimed. A. J. E. W.

Microchemical examination of explosives and ammunition.—See B., 1938, 1105.

Field test for phosphates. M. C. OAKES (Econ. Geol., 1938, **33**, 454—457).—Utilisation of the NH_4 phosphomolybdate test is described. The test is sensitive to $<0·5$% P_2O_5 in nodules, limestone, shale, and chert. L. S. T.

Sensitisation of paper strips with filtered mercuric bromide solution in Gutzeit method of arsenic analysis. R. S. ROSENFELS (J. Assoc. Off. Agric. Chem., 1938, **21**, 493—496).—The $HgBr_2$ solution can be used for 3—4 months provided it is filtered before strips are prepared from it. Strips kept >21 days were satisfactory. E. C. S.

Determination of traces of arsenic by electrolytic hydrogenation. Experimental study of the mechanism of the technique. Comparison with chemical hydrogenation. H. GRIFFON and J. THURET (Bull. Soc. chim., 1938, [v], **5**, 1129—1142).—The electrolytic method is applicable in presence of all concns. of neutral salts, gives a const. evolution of H_2, and yields very reproducible results. The chief disadvantage is the necessity for comparatively complex and expensive apparatus. The accuracy of both methods is about the same. C. R. H.

Determination of small quantities of carbon in steel.—See B., 1938, 1048.

Determination of traces of carbon monoxide in the air of mines.—See B., 1938, 1005.

Laboratory measurements by means of physical methods. T. KRASSÓ (Tech. Kurir, 1938, **9**, 63—65).—For determining minute amounts of CO_2 the change in conductivity of a $Ba(OH)_2$ solution when CO_2 is introduced is measured. In measurement of short periods by means of a micro-coulometer with reactions which can be followed electrometrically, the quantity of the gas evolved in the coulometer $\propto$ the time of the reaction; a detailed description of the apparatus is given. E. P.

Determination of ferrocyanide. R. HÜNERBEIN (Angew. Chem., 1938, **51**, 539—540).—The reaction $K_4Fe(CN)_6 + 3Hg(OH)_2 \rightleftharpoons Fe(OH)_2 + 3Hg(CN)_2 + 4KOH$, can be caused to proceed to completion by use of $Hg(OAc)_2$ in slightly alkaline solution. Conversion of $Hg(CN)_2$ into HCN is best effected by distillation with HCl or, preferably, HBr. A suitable apparatus is described. *Salts* $Hg_2Fe(CN)_2,2H_2O$, $Hg_3[Fe(CN)_6]_2,3H_2O$, and $Hg_3[Co(CN)_6]_2,2·5H_2O$ have been isolated. The last is considerably more stable than the corresponding Fe compounds; when heated at 300° it gives $Hg(CN)_2$, $Co_3[Co(CN)_6]_2$, and C_2N_2. H. W.

Electrolytic determination of non-metallic inclusions in steel.—See B., 1938, 1048.

Microscopical determination of potassium with naphthol-yellow S. H. A. FREDIANI (Ind. Eng. Chem. [Anal.], 1938, **10**, 447—449).—$K^{\cdot}$ can be determined in presence of excess of $NH_4^{\cdot}$ (200 : 1) at a limiting concn. of 7·5 mg. per ml. by microscopical observation of the cryst. ppt. formed with aq. naphthol-yellow S saturated at 20°. Rb forms similar crystals, but $Mg^{\cdot\cdot}$, $Na^{\cdot}$, $Li^{\cdot}$, and $Cs^{\cdot}$ do not interfere. Acid samples should first be neutralised by K-free NaOH. E. S. H.

Spectrocolorimetric determination of potassium. H. LUNDEGÅRDH and K. BORATYNSKI (Svensk Kem. Tidskr., 1938, **50**, 135—144).—Determination of elements by direct photometry of spectral line intensity is the most accurate method available, but the apparatus is costly and very sensitive to external disturbances. A simpler method is to determine the amount of light passing a filter of appropriate range. K is determined by its lines at 7665 and 7699 A., using a filter transparent between 7000 and 10,000 A. When determining K in soils or plant ash interference is caused by Ba, Cs, Rb > Mn, Sr, Fe > Na, Li, Ca. Mg and Cu do not interfere. When Ca is present in excess it may be compensated for by its determination by the band in the red in the same way, but owing to imperfections of the filter Na interferes. NH_4Cl causes errors by lowering the flame temp. The method is accurate to about 5%. M. H. M. A.

Inorganic micro-methods. I. Cations. I. CLAUDATUS and G. GHIMICESCU (Ann. Sci. Univ. Jassy, 1938, **24**, I, 357—369).—Methods are described for the following: *Na*. Pptn. with Zn uranyl acetate and colorimetry with $K_4Fe(CN)_6$. *K*. Pptn. as the cobaltinitrite, treatment with 5% Na_3PO_4, and colorimetric determination of NO_2' by means of an AcOH solution of salipyrine. *NH*$_4$. Adsorption of NH_4^+ on zeolite, liberation of NH_3 by NaOH, and nesslerisation. *Fe*. $Fe(CNS)_3$ extracted with EtOAc and determined colorimetrically. *Mn*. Conversion into MnO_4' (S_2O_8'' and Ag^+) and colorimetric determination. *Pb*. Pptn. as $PbCrO_4$ in dil. AcOH, and colorimetric determination with diphenylcarbazide. L. S. T.

Determination of the soda–potash content of combined alkali in soaps etc.—See B., 1938, 1070.

Separation and detection of the elements of the silver and thallium group. I. WADA and R. ISHII (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 787—818).—A procedure for the separation of Ag, Tl and Au, Ga, and In from each other and from the elements with which they are likely to be associated has been developed. Ag is pptd. with HBr, and Tl with most of the Au is extracted from the filtrate (N in acid) with Et_2O. The acid solution is converted into a 5·5N-HCl solution, and Et_2O-extracted, whereby all the Ga and Fe^{III} are removed, and some of the Mo, Re, Ir, and the remaining Au. These latter are pptd. with H_2S, when the Et_2O extract has been converted into a HCl solution. The filtrate is diluted to be 0·1N and the Fe^{III} reduced to Fe^{II} with H_2S, the solution being again extracted with Et_2O; the extract now contains all the Ga but very little Fe. The small amount of Fe with the Ga may be removed by adding NaOH to the Et_2O extract, when it has been made into an aq. solution. Ga can now be detected by adding $K_4Fe(CN)_6$, with which it gives a white ppt. The original 5·5N-HCl solution from which the Ga was extracted may contain In, together with Fe^{III} and traces of Mo, Ir, Te, and Re; it is converted into a 4·5N-HBr solution, which is Et_2O-extracted, the extract is converted into a HCl solution, from which Mo, Te, Re, and Ir are pptd. with H_2S. The filtrate is boiled, and NH_4Cl and aq. NH_3 are added, whereby In and Fe are pptd. The ppt. is dissolved in 6N-HCl, and the Fe extracted with Et_2O, In being practically inextractable from so acid a solution. R. C. M.

Quantitative analysis based on spectral energy. M. SLAVIN (Ind. Eng. Chem. [Anal.], 1938, **10**, 407—411).—Limitations of the internal-standard method are discussed, and measurement of energy of spectral emission is recommended in place of intensity. The spectral energy in a C arc $\propto$ the wt. of element causing the emission. Results for Ca in various minerals show an average error of 8·3% and a max. error of 18·5%. The presence of other elements does not interfere. E. S. H.

Microchemical test for magnesite. H. L. PIOTROWSKI (Spraw. Tow. Nauk. Lwow, 1934, **14**, 233—234).—On treating magnesite with a solution of 1 part of KOH and 0·1 part of Ti-yellow in 100 parts of H_2O, the mineral turns fire-red. Dolomite and calcite are unaffected. Clay minerals turn citron-yellow. CH. ABS. (*e*)

Rapid determination of magnesium in aluminium alloys.—See B., 1938, 1057.

Electrochemical separation [differentiation] of alloys.—See B., 1938, 1057.

Determination of lead. O. BRUNCK (Z. anal. Chem., 1938, **113**, 385—389).—Methods of determining Pb as $PbSO_4$, $PbCrO_4$, $Pb_3(PO_4)_2$, and PbS are discussed. The recommended method of determination as PbS is to dissolve the sample in about 10 c.c. of HNO_3 (*d* 1·18), heat until all the HNO_3 is expelled, dilute to 150—200 c.c., and then pass a slow stream of H_2S. Pptn. is complete in ½ hr. The ppt. is collected in a weighed sintered glass crucible, washed with cold H_2O, and dried at 110—120°. Amounts of Zn $>$0·2 g. per 100 c.c. are not pptd. under these conditions, and other ions are not adsorbed on the cryst. PbS so deposited. Separation of Cd and Zn by an analogous procedure is impossible, even with a higher [HNO_3], since the CdS pptd. is partly amorphous. J. W. S.

Detection of lead ions in the lead compounds of the homœopathic pharmacopœia.—See B., 1938, 1097.

Spectroscopic analysis of the products of lead, cadmium, and zinc plants.—See B., 1938, 1051.

Comparison of gravimetric and electrolytic methods of determining copper in copper sulphate. F. I. BOGOJAVLENSKI (Utschen. Zap. Univ. Kazan, 1938, **97**, No. 8, 95—113).—Six pptn. and seven electrolytic methods have been tested. Pptn. by KSCN after reduction by SO_2 or NH_4HSO_3, and electrodeposition in presence of HNO_3 (Luckow's method) are recommended. J. J. B.

Determination of copper and cadmium in zinc.—See B., 1938, 1050.

Reactions of rare earth and allied elements with polyhydric phenols and alkaloids. VI. Colorimetric determination of cerium, with brucine. F. M. SCHEMJAKIN, V. A. VOLKOVA, and A. S. BOSHKO (J. Gen. Chem. Russ., 1938, **8**, 452—455).—A mixture of Ce-containing mineral, conc. H_2SO_4, $(NH_4)_2S_2O_8$, and aq. $AgNO_3$ is heated for 1 hr., the product is dissolved in H_2O, an aliquot part containing 0·014—1 mg. Ce is made neutral with aq. NH_3, 0·5 ml. of 0·1M-H_2SO_4 and 2 ml. of 0·01M-brucine acetate are added, and the coloration is compared after 16 hr. with those given by a series of standards. R. T.

Volumetric determination of cerous in presence of ceric salts. L. WEISS and H. SIEGER (Z. anal. Chem., 1938, **113**, 305—325).—Numerous methods have been critically examined. (1) *Ce*^{IV} *by reduction.* The H_3AsO_3 method using ICl (HCl solutions) or OsO_4 (H_2SO_4 solutions) as catalysts is satisfactory, but titration of $Ce^{\cdots\cdot}$ with H_2O_2, especially in presence of HNO_3, is inaccurate. $FeSO_4$ or $K_4Fe(CN)_6$ gives exact results with *o*-phenanthroline–$Fe^{\cdot\cdot}$ indicator in presence of HCl or H_2SO_4, but HNO_3 must be absent. (2) *Ce*^{III} *by oxidation.*

Job's PbO_2 method (A., 1899, ii, 334) is inaccurate. Knorre's $(NH_4)_2S_2O_8$ method (A., 1898, ii, 311) in its original form gives low results, but has been modified satisfactorily. Oxidation in alkaline medium with $K_2S_2O_8$ and iodometric titration of the $Ce^{\cdots\cdot}$ according to Štěrba-Böhm and Matula (A., 1925, ii, 716) gives high (10—20%) results. Similar oxidation in presence of $Ni^{\cdot\cdot}$ and titration with H_3AsO_3 by Lang and Zweřina's method (A., 1933, 137) gives low (0·2—3·4%) results. The Bi_2O_4 method (Waegner and Müller, A., 1903, ii, 242) also gives low (10%) results. Lang's CrO_3 method (A., 1934, 982) is accurate in HNO_3, but less so in HCl and especially in H_2SO_4 solutions. Oxidation in alkaline solution with $K_3Fe(CN)_6$ and titration of the $K_4Fe(CN)_6$ formed with $KMnO_4$ (A., 1908, ii, 736) is considered to be the best and the simplest method for the determination of $Ce^{\cdot\cdot\cdot}$ in presence of $Ce^{\cdots\cdot}$. Tomiček's potentiometric method (A., 1925, ii, 716) is very accurate. L. S. T.

Quantitative spectrographic analyses of alloys. Influence of a third metal on the Al : Mg intensity ratio in light metal analysis.—See B., 1938, 1057.

Determination of manganese and of the active oxygen in its higher oxides. J. A. Muller (Bull. Soc. chim., 1938, [v], **5**, 1162—1165).—Mn is determined as $MnSO_4$ and the latter can be converted into Mn_3O_4. Active O is determined by the liberation of I from KI by means of HCl in an atm. of CO_2. C. R. H.

Rapid determination of minute amounts of iron in must, wine, and cider.—See B., 1938, 1090.

Application of citric acid to determination of nickel in presence of salts of iron and of phosphoric acid. V. P. Golendeev (Rept. U.S.S.R. Fat and Marg. Inst., 1935, No. 2, 22—26).—10 c.c. of 10% aq. Na citrate are added to 20 c.c. of the solution, the mixture is heated at 100° for 15—20 min., cooled, 10 c.c. of 10% aq. NH_3 are added, and the solution is made up to 250 c.c. with H_2O. 10 c.c. of 0·04N-KCN are added to 20 c.c. of this solution and the excess of KCN is titrated with 0·02N-$AgNO_3$. Ch. Abs. (e)

Determination of small amounts of nickel in presence of large amounts of iron. E. Reichel and L. Stuzin (Z. anal. Chem., 1938, **113**, 389—419).—A method has been developed for determination of 3×10^{-5} to 10^{-4} g. of Ni in presence of 1000—15,000 times its wt. of Fe. $Zn^{\cdot\cdot}$ corresponding with about 100 times the wt. of the Ni present is added to the HCl solution of the sample, NH_4F solution run in until the solution is decolorised, and the Zn and Ni are then pptd. together with $K_3Fe(CN)_6$. The ppt. is ashed, dissolved in conc. HCl, and after making the solution slightly alkaline with NH_3 the Ni is pptd. by addition of an excess of solid dimethylglyoxime. This ppt. is washed, ignited, and redissolved in HCl, the solution being evaporated to dryness on a water-bath. The $NiCl_2$ is dissolved in H_2O and Ni determined colorimetrically as NiS. J. W. S.

Determination of molybdenum in steels with the Pulfrich photometer.—See B., 1938, 1048.

Hydroxyanthraquinones as analytical reagents. Colorimetric determination of zirconium or hafnium. H. A. Liebhafsky and E. H. Winslow (J. Amer. Chem. Soc., 1938, **60**, 1776—1784).—Procedure for the colorimetric determination of small amounts of Zr or Hf by means of 1 : 2-di-, 1 : 2 : 4-tri-, and 1 : 2 : 5 : 8-tetra-hydroxyanthraquinone, using a photo-electric recording spectrophotometer, is described. The method involves lake formation at great dilution in 95% EtOH. The influence of acid concn. on the formation of the lakes has been studied. Zr and Hf are qualitatively indistinguishable in the test. Other cations interfere only when they are present in considerable excess. E. S. H.

Determination of antimony. (A) P. E. Winkler (Bull. Soc. chim. Belg., 1938, **47**, 403). (B) J. Pens (*ibid.*, 404).—(A) The principle of Pens' method (A., 1938, I, 274) has been suggested previously by various authors. Winkler's iodometric method (A., 1927, 1160) has also proved satisfactory.
(B) A reply. J. W. S.

M.p. and b.p. on a micro- and macro-scale under various pressures. C. Rosenblum (Ind. Eng. Chem. [Anal.], 1938, **10**, 449).—Apparatus is described. E. S. H.

Low-temperature evaporator. D. S. Stevens J. Lab. clin. Med., 1938, **23**, 978—979). C. J. C. B.

Constant-temperature water-bath for solubility measurements. W. J. Knox, jun. (J. Chem. Educ., 1938, **15**, 343—344).—Details of construction are given. L. S. T.

Photo-electric thermoregulator. A. Gross and M. Bassière (Bull. Soc. chim., 1938, [v], **5**, 1228—1231).—A regulator is described in which a relay is operated by a light source which is interrupted by means of a piece of Al foil attached to the end of a needle of a galvanometer, the latter acting as the temp. indicator. A drop in temp. is followed by a deflexion of the needle with the result that light passes to the photo-electric cell connected with the relay. The regulator will maintain temp. of 200—1200° within ±0·5°. C. R. H.

Liquefaction of helium. I. L. Zelmanov (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 469—470).—In the process based on the Joule–Thomson effect, the discrepancy between the yield of liquid He and that expected from Keesom's T–S diagram is attributable to miscalculation of the liquefaction coeff.; for certain isenthalpies heat exchange may be impossible. Practical modifications to avoid this are outlined. I. McA.

Light filter for the isolation of the green mercury line. O. Stoll (Ber., 1938, **71**, [*B*], 1576—1577).—A half-saturated solution of $NdCl_3$ to which 20 wt.-% of $CuCl_2$ (calc. on H_2O used) has been added has 80% transparency for the green lines and >0·1% transparency for the yellow and blue lines and is opaque to the red, violet, and ultra-violet lines of the Hg spectrum. A saturated solution of $Nd(NO_3)_3$ containing $CuCl_2$ removes all light from the Hg spectrum or white light except a small spectral

region around 5460 A. The solution is stable to light and can be preserved unchanged. H. W.

Inexpensive microscope lamp for critical illumination. J. G. CARLSON (Stain. Tech., 1938, **13**, 97—100).—A microscope lamp with light of adjustable intensity is described. Light filters can be made by mounting layers of coloured Cellophane in balsam between glass slips. E. E. H.

Photo-electric colorimeter. K. HARE and R. E. PHIPPS (Science, 1938, **88**, 153—154).—The instrument described utilises a balanced circuit achieved by the use of a variable resistance in the circuit of one of the photo-electric cells. L. S. T.

Simplified colorimetric technique. R. SEIFERT (Süddeuts. Apoth.-Ztg., 1936, **76**, 376—377; Chem. Zentr., 1936, ii, 823).—Measurements carried out with very simple apparatus are described. H. J. E.

Objective measurement of colour. J. W. PERRY (J. Sci. Instr., 1938, **15**, 270—277).—The general principles of direct colour measurement based on the use of filter-screened photocells and the exact determination of the coeffs. in a trichromatic specification, and the application of these principles to " blancometers," are examined. Categories embracing spectrophotometrically similar colours and colorimetry over the whole colour field are distinguished. The instruments and their application to the measurement of colour differences are described. N. M. B.

New fluorometer. O. MAERCKS (Z. Physik, 1938, **109**, 685—699).—A method for measuring fluorescence resonance periods with an accuracy of 2×10^{-10} sec. is described. The exciting radiation is interrupted by a train of supersonic waves of known frequency and the fluorescent light is passed through the same or another train of supersonic waves. The resulting displacement is a measure of the fluorescence resonance period. H. C. G.

Application of the neon lamp and copper oxide photo-electric cell to volumetric analysis (photometric titration). T. SOMIYA (Congr. int. Quim. pura apl., 1934, **9**, VI, 63—69; Chem. Zentr., 1936, ii, 3152; cf. B., 1935, 854).—The titration solution is placed between a source of light and a Cu oxide photo-electric cell or a Ne lamp (which is silvered except for a small window) and, using a liquid light filter if necessary, titration is followed by galvanometer deflexions. Increased accuracy and sensitivity are claimed. A. H. C.

Instructions for crystal measurement with new model of the two-circle goniometer. P. TERPSTRA (Rec. trav. chim., 1938, **57**, 893—904). F. L. U.

Graphic method of determining the optic sign and the true axial angle from the refractive indices of biaxial minerals. J. H. LANE, jun., and H. T. U. SMITH (Amer. Min., 1938, **23**, 457—460). L. S. T.

Ultra-violet rays in the laboratory. H. PIRAUX (Tech. Ind. Chim., 1938, No. 277 bis, 190).—The application of ultra-violet (Wood's) light to fluorescence analysis etc. is reviewed. I. C. R.

Quantitative *X*-ray analysis of crystalline powders. K. SCHÄFER (Z. Krist., 1938, **99**, 142—152; cf. Glocker, A., 1934, 979; Brindley, A., 1938, I, 124).—Detailed procedure is given for the optimum application of standard (Laue) theory of abs. *X*-ray intensities to the analysis of fine-grained mixtures by photometry of selected reflexions from cylindrical specimens. Results for 50–50% binary mixtures or alloys (NaCl–KBr, $CuAl_2$–Al) are accurate to 3%. For components in low concn. or complicated lattices, calibration is preferable. I. McA.

Extension of the double-crystal *X*-ray spectrometer. M. RENNINGER (Z. Krist., 1938, **99**, 181—187).—A three-crystal arrangement aiming at the high resolution necessary for the analysis of real crystal reflexions is compared in substance and scope with DuMond's instrument (A., 1938, I, 15). The advantage of its highly monochromatic narrow beam is shown in consideration of calcite reflexions of Mo $K\alpha$ rays monochromatised by two " ideal " diamonds. I. McA.

Determination of indices of stereographically projected crystal surfaces. H. TERTSCH (Z. Krist., 1938, **99**, 61—66).—A discussion of (known) graphical methods. I. McA.

Apparatus for electrometric titrations of high precision. E. STENHAGEN (Ind. Eng. Chem. [Anal.], 1938, **10**, 432—433).—Apparatus for general purposes and for titrations in org. solvents is described. A special stirring device renders the apparatus suitable for titrations in an inert atm. E. S. H.

Glass electrode for differential titrations. M. PAIĆ (Compt. rend., 1938, **207**, 151—153).—A glass electrode for differential titrations consists essentially of a glass U-tube slightly constricted at the middle and separated into two compartments by a glass (Corning 015) membrane. Each compartment contains the same amount of liquid for titration. Various amounts of titrating liquid are added and the difference between the amounts added to the two compartments is maintained at a const. small quantity. With each addition the difference in potential between the two sides of the membrane is measured and a differential titration curve is thus obtained. By using a standardised glass electrode the differential and abs. titration curves are obtained simultaneously. The dissociation consts. of weak acids and bases and the p_H at the point of neutralisation can be determined with greater accuracy than from an abs. curve either alone or combined with a calc. differential curve. W. R. A.

Electrical measurement of p_H. J. VASSILLIÈRE-ARLHAC (Tech. Ind. Chim., 1938, No. 277 bis, 185—187).—A review of the principles of the method, methods of measurement, and the electrodes available. I. C. R.

Purification of organic solvents intended for conductometric measurements. L. DE BROUCKÈRE and A. PRIGOGINE (Bull. Soc. chim. Belg., 1938, **47**, 399—402).—Commercial PrOH was purified by heating for $\lt 15$ hr. in presence of CaO, distilling, and then fractionating. The fraction of b.p. 97—97·3° and κ $3-6 \times 10^{-8}$ ohm was redistilled at 40°/40—50 mm. in a slow stream of H_2. The

conductivity of the distillate was a min. for the middle fraction, the lowest val. of κ observed being $0{\cdot}44 \times 10^{-8}$ ohm. The same method can be applied to other solvents. J. W. S.

Measuring e.m.f. and very small direct currents with the help of electrometer tubes. F. MÜLLER (Korros. u. Metallschutz, 1938, **14**, 193—198).—The principles and technique of the method are described, and the conditions to be observed in its use are discussed. C. E. H.

Measurement of large electrolytic resistances. L. DE BROUCKÈRE and A. PRIGOGINE (Bull. Soc. chim. Belg., 1938, **47**, 382—398).—A d.c. potential is applied to a conductivity cell containing the liquid of high sp. resistance (ρ), and the current passing is compared with that observed when the cell is replaced by known resistances. Measurements of ρ for H_2O, MeOH, and PrOH are complicated by polarisation, but if the resistance of the cell is high and the c.d. low this may be corr. by extrapolation of the current–time curve. Ohm's law holds for PrOH providing that a low p.d. is used and electrolysis is not prolonged. J. W. S.

Electrodialysis. H. DE BRUYN and S. A. TROELSTRA (Kolloid-Z., 1938, **84**, 192—195).—Improved apparatus, the chief features of which are simplicity of construction and economy of wash-H_2O, is described. F. L. U.

Electrostatic generator operating under high air pressure. R. G. HERB, D. B. PARKINSON, and D. W. KERST (Physical Rev., 1937, [ii], **51**, 58).—A belt type electrostatic generator operating under an air pressure of 100 lb. per sq. in. gives a max. potential of approx. 2500 kv., and has been successfully used in experiments on at. disintegration. L. S. T.

Electrostatic generator for the production of positrons. G. B. COLLINS, R. SCHAGER, and A. L. VITTER (Physical Rev., 1937, [ii], **51**, 58). L. S. T.

Million-volt cyclotron. P. G. KRUGER and G. K. GREEN (Physical Rev., 1937, [ii], **51**, 57).—A cyclotron producing 2·5 μamp. of deuterons at 10^6 e.v. energy and permitting the study of nuclear disintegrations without the intense fields of the cyclotron affecting the detecting apparatus has been constructed. L. S. T.

Direct current of stabilised voltage for the Tag–Heppenstall moisture meter and other laboratory instruments. E. B. WORKING (Cereal Chem., 1938, **15**, 500—508).—The Tag–Heppenstall moisture meter requires d.c. of widely variable magnitude, at very const. voltage. Two rectifier circuits, and a third incorporating an electronic voltage regulator, which fulfil these requirements are shown. E. A. F.

Electron microscope. G. SELÉNYI (Tech. Kurir, 1938, **9**, 57—58).—A review. E. P.

Particle counter. D. DE SOUZA SANTOS and G. WATAGHIN (Nuovo Cim., 1938, **15**, 104—107).—A modified Geiger–Müller counter, with plane and parallel grating electrodes, is described. O. J. W.

Electron scanning microscope. M. VON ARDENNE (Z. Physik, 1938, **109**, 553—572).—A very fine beam of electrons is produced by means of a two-stage electron optical reducing system. The beam is made to scan the object by the application of suitably synchronised electric or magnetic fields. Electron indicators are arranged to measure either the transmitted portion of the beam or the intensity of the electrons scattered or reflected through any selected angle by the object. The result is recorded in conjunction with the synchronised deflecting field to produce an image of the object. The various factors limiting the definition are considered and the limit of resolution is assessed at $\approx 10^{-5}$ mm. H. C. G.

Apparatus for determining the transmission of slow electrons through thin collodion films. M. FERENCE and R. J. STEPHENSON (Rev. Sci. Instr., 1938, **9**, 246—248).—A description and operational details are given of an apparatus for determining the transmission of slow electrons (800—34,000 e.v.) through thin collodion films (10^{-3}—7×10^{-6} cm.). W. R. A.

Electronic voltage regulator with supplementary circuit to supply low voltages. E. B. WORKING (Ind. Eng. Chem. [Anal.], 1938, **10**, 434—435).—Apparatus is described. E. S. H.

Method of determining the direction and for the separation of α- and H-rays in an ionisation chamber. J. SCHINTLMEISTER (Physikal. Z., 1938, **39**, 612—615).—An ionisation chamber which is divided into two compartments by a gauze electrode is described. By double registration of each ray it is possible to determine the range and direction of the rays in the chamber and to decide whether the ray is an α- or an H-ray. A. J. M.

Measurement of high-energy γ-rays. E. R. GAERTTNER and H. R. CRANE (Physical Rev., 1937, [ii], **51**, 58—59).—The target in a small thimble is constructed inside a cloud chamber, which is bombarded by an ion beam for an instant at the time of expansion. Tracks appearing in the chamber originate in the thin wall of the thimble. With Li bombarded by protons, using 0·7 mm. brass wall, many electron pairs and single negative electrons having the entire available energy, 17 Me.v., were observed. L. S. T.

Semi-micro-fractionating column. S. D. LESESNE and H. L. LOCHTE (Ind. Eng. Chem. [Anal.], 1938, **10**, 450).—The apparatus is for use at atm. pressure on 1—10 c.c. of liquid. The packing is replaced by a metal band rotating at 1000 r.p.m. E. S. H.

Powder measurer. R. P. WODEHOUSE (Ind. Eng. Chem. [Anal.], 1938, **10**, 423—424).—Apparatus is described. E. S. H.

Anti-foaming device for use in concentration of non-inflammable liquors. E. A. GASTROCK and J. D. REID (Ind. Eng. Chem. [Anal.], 1938, **10**, 440).—An electrically heated coil in the vapour disrupts the foam bubbles without contact. E. S. H.

Ring method for measurement of surface tensions. D. G. DERVICHIAN and C. CLARK (Compt. rend., 1938, **207**, 277—279).—γ may be calc. from the pull P necessary to drag a ring from the surface of the liquid, using the experimentally deduced relation

$\gamma/\rho = aP/\rho + b$, a and b being consts. for a given ring. The independence of the menisci inside and outside the ring (cf. Freud, A., 1930, 853) has been confirmed. The ring may cause rupture of adsorption layers, which is indicated by a progressive increase in the vals. of γ given by successive measurements. A. J. E. W.

Maintenance of clean surfaces in glass tubes containing mercury. W. H. J. Vernon and E. G. Stroud (Chem. and Ind., 1938, 796).—Introduction of sufficient syrupy H_3PO_4 (d 1·16—1·75) to cover the Hg surface prevents fouling of the walls of manometer tubes through oxidation of the exposed Hg surface, and for many purposes has no countervailing disadvantage. J. W. S.

Method of diminishing the sticking of mercury in capillaries. P. Rosenberg (Rev. Sci. Instr., 1938, **9**, 258—259).—The sticking of Hg in a capillary can be greatly reduced by using a capillary the internal surface of which has a ground finish. A method for giving a ground surface to capillary bores with wire and abrasive is described. W. R. A.

Speed indicator and control for the ultra-centrifuge. H. Kahler (Rev. Sci. Instr., 1938, **9**, 257).—A photo-cell method for the determination of the speed of the centrifuge in the range 10—5000 cycles per sec., with an accuracy of 1%, is described. Two alternative methods of speed control are outlined. W. R. A

Engine for smoothing small tungsten wires. R. P. Johnson, A. B. White, and R. B. Nelson (Rev. Sci. Instr., 1938, **9**, 253—255).—An engine for removing die marks from the surface of small W wires (2 to 10 mils diameter) by mechanical abrasion is described. W. R. A.

Micro-constant extraction apparatus for liquids. F. C. Messer (J. Lab. clin. Med., 1938, **53**, 618—620).—An apparatus which permits the const. extraction of 1—10 c.c. of fluid with a lighter, non-miscible solvent is described. T. H. H.

Automatic evaporation controller and signal. H. B. Wylie (J. Lab. clin. Med., 1938, **53**, 642—645). T. H. H.

Apparatus for agitating small volumes of liquid at constant temperature. R. G. Willcocks (J.S.C.I., 1938, **57**, 249—250).—A machine in which small tubes or flasks can be shaken vigorously in a thermostatic bath is described. The tubes are fixed vertically in sprung clips and struck by flexible vanes revolving on a vertical shaft, rotated by an electric gramophone motor. The machine is self-contained, silent in operation, admits ease of sampling, and can be used in bacteriological, biochemical, and chemical experiments. A no. of applications are suggested.

Universal laboratory shaker. J. M. Feder (J. Lab. clin. Med., 1938, **23**, 974—977). C. J. C. B.

Simplified shaking apparatus. J. H. Holt (J. Lab. clin. Med., 1938, **23**, 533). C. J. C. B.

Stirring device for use in micro-titrations. P. Levantinsky (J. Lab. clin. Med., 1938, **23**, 532—533). C. J. C. B.

Differential method for the measurement of small amounts of adsorbed gas. W. Hunsmann (Z. Elektrochem., 1938, **44**, 540—542).—The apparatus incorporates two heated-wire manometers, one of which is connected with the adsorption vessel and the other with a Hg burette. The galvanometer needle, the deflexion of which $\propto$ the vol. of adsorbed gas, is brought back to the null point by equalising the pressures by running from the burette a vol. of Hg equiv. to the vol. of adsorbed gas. C. R. H.

Modern equipment for the chemical laboratory. J. Marteret (Tech. Ind. Chim., 1938, No. 277 bis, 175—184). I. C. R.

Vacuum relay. C. W. Miller (J. Sci. Instr., 1938, **15**, 263—265).—In the arrangement described a Pirani gauge is used in an a.c. control circuit to open or close an external circuit when the pressure in a vac. system exceeds any given val. N. M. B.

Distillation flasks with condenser for small quantities of substances. J. Erdös (Mikrochem., 1938, **24**, 278—279).—A small flask is provided with a ground-in vertical condenser, which delivers into a funnel and side tube (with tap) sealed into the neck of the flask; this is convenient for removing solvents etc. E. W. W.

Vapour-jet vacuum pumps. H. Klumb (Z. tech. Physik, 1936, **17**, 201—202; Chem. Zentr., 1936, ii, 1388).—A simplified glass pump of high pumping speed, and operating with a fore-vac. of several mm. of Hg, is described. H. J. E.

Corrosion of platinum apparatus.—See B., 1938, 1051.

Burette holder. O. J. Stewart (J. Chem. Educ., 1938, **15**, 335). L. S. T.

Separation of gaseous mixtures by diffusion. E. H. Riesenfeld and T. L. Chang (Arkiv Kemi, Min., Geol., 1938, **12**, **A**, No. 19, 1—8).—By experiments on the separation of O_2–CO_2 mixtures by diffusion through porous tubes, it was found that the separation factor falls as the concn. of the heavy constituent rises. The relation between separation factor and $[CO_2]$ is logarithmic. This can be explained qualitatively if it is assumed that CO_2 mols. absorbed on the pores of the diffusion tube are drawn through by the vac. pump, thereby reducing the separation caused by diffusion. T. H. G.

Out-gassing of heated metals in a vacuum. J. A. M. van Liempt (Rec. trav. chim., 1938, **57**, 871—882).—Formulæ are derived for the rate of out-gassing of metals in the form of sheet or wire, and for the times required for the loss of 95 and 98% of the gas. The formulæ agree with experimental data for Ni. F. L. U.

Sedimentation unit and its use in field sampling. G. H. Otto (J. Geol., 1938, **46**, 569—582). L. S. T.

Separation of gases and isotopes. K. Clusius and G. Dickel (Naturwiss., 1938, **26**, 546).—The apparatus consists of a vertical hot surface (an electrically heated wire) opposite to a cold one. Thermal diffusion and convection result in the heavier

component of the mixture becoming relatively more conc. at the bottom of the apparatus. A 1 : 3 mixture of Br and He was completely separated by this method, and good results were also obtained with a 2 : 3 mixture of CO_2 and H_2, and with air. Normal Ne (at. wt. 20·18) was partly separated into its isotopes, the gas drawn from the bottom of the apparatus having at. wt. 20·68, corresponding with an alteration in the ratio of ^{22}Ne : ^{20}Ne from 1 : 9·28 to 1 : 2·20. Normal HCl (23% $H^{37}Cl$, 77% $H^{35}Cl$) gave a mixture of 40% of $H^{37}Cl$ and 60% of $H^{35}Cl$ at the base of the apparatus. A. J. M.

Theory of the measurement of viscosity and slip of fluids by the oscillating-disc method. II. G. E. MACWOOD (Physica, 1938, **5**, 763—768; cf. A., 1938, I, 352).—Theoretical. H. J. E.

Ultrafilters of graduated porosity. J. DUCLAUX and M. AMAT (Compt. rend., 1938, **206**, 1475—1477).—The filters are prepared by immersing in H_2O a glass plate previously coated with a solution of cellulose acetate (I) in saturated aq. $Mg(ClO_4)_2$. Filters 0·06—6 mm. thick may be obtained, the porosity varying with the concn. of (I) (2—20%) in the solution used. Very low porosity is obtained by immersing in dil. aq. $Mg(ClO_4)_2$ and drying before use. Similar filters may be prepared on filter-paper, cloth, or gauze. A. J. E. W.

Electronic recording analytical balance. R. H. MULLER and R. L. GARMAN (Ind. Eng. Chem. [Anal.], 1938, **10**, 436—440).—Inertia- and lag-free electronic methods are substituted for mechanical or electrical contactors, relays, etc. The sensitivity is about 0·05 mg. for a 20-g. load. E. S. H.

Rapid solution-dispensing pipette. B. J. OTTE, P. J. THOMPSON, and G. A. BARBER (J. Chem. Educ., 1938, **15**, 344). L. S. T.

[Laboratory] experiment illustrating the relation between e.m.f. and the equilibrium constant. R. LIVINGSTON and J. J. LINGANE (J. Chem. Educ., 1938, **15**, 320—323).—The reaction utilised is quinol + $2Ag^{\cdot}$ = *p*-benzoquinone + 2Ag + $2H^{\cdot}$. The e.m.f. method measures the e.m.f. of the cell Pt|quinhydrone, HNO_3 (0·1M)|HNO_3 (0·1M)|HNO_3 (0·1M), $AgNO_3$ (0·001M)|Ag. Measurements can be made in presence of air, the temp. coeff. is large and practically linear between 19° and 32°, the cell attains const. e.m.f. very rapidly after a change in temp., and the liquid junction potential is negligible. The analytical method starting with known concns. of reactants or reacting products is also described. L. S. T.

Geochemistry.

Vertical distribution of ozone in the atmosphere. V. H. REGENER (Z. Physik, 1938, **109**, 642—670).—An extension of earlier work (A., 1938, I, 279) involving the use of a self-registering ultra-violet spectrograph for balloon ascents. L. G. G.

Ice of the Arctic regions. V. I. VERNADSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 625—628).—The mineralogy of Arctic waters, the biochemistry and distribution of the diatomaceous Si and Al, and the nature of cosmic dust in ice inclusions are discussed. I. McA.

Concentration of calcium carbonate in the waters of the Polar basin. N. I. TSCHIGIRIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 633—635).—The solubility of $CaCO_3$ in sea-H_2O so depends on $[CO_2]$, temp., and hydrostatic pressure that, of the three chemically-differentiated Polar ocean layers, the warm saline Atlantic layer (depth 110—950 m.) containing 3·37—3·39 g. of $CaCO_3$ per kg. of solute is ~2% supersaturated, whilst the abyssal and surface layers containing 3·39—3·49, 3·42—3·60 g., respectively, are > 98% saturated with $CaCO_3$. The balance of $[CaCO_3]$ in Arctic and Atlantic waters and the high concn. in the Polar upper layer are maintained by the drift and melting of old ice, in which the $[CaCO_3]$ may reach 1000 times that in sea-H_2O. The bearing on marine geology and biology is indicated. I. McA.

Respiration and assimilation in open water. Quantitative studies on the variations in organic matter in lakes near Seeon. K. HEINRICH (Intern. Rev. Hydrobiol., 1934, **30**, 387).—Comprehensive data are given. CH. ABS. (*e*)

Analysis of mineral water of Lesignano Bagni (Parma). G. ILLARI and M. ZUCCHETTI (Annali Chim. Appl., 1938, **28**, 258—275).—Data for the chemical and physico-chemical characteristics of the H_2O and dissolved gases are tabulated. F. O. H.

Salt waters on the coast of Peru containing sodium carbonate. F. FUCHS (Bol. Soc. Quim. Peru, 1935, **1**, No. 3, 29—46; Chem. Zentr., 1936, ii, 771).—The material is partly washed from rocks and partly formed by interaction of Na_2SO_4 and NaCl with $CaCO_3$. H. J. E.

Oxygen-poor waters of Chesapeake Bay. C. L. NEWCOMBE and W. A. HORNE (Science, 1938, **88**, 80—81).—A well-defined O_2 stratification occurs in this bay during summer. The surface stratum, which has a low salt content and high O_2 content, overlies a bottom layer of much higher salinity and very low $[O_2]$. L. S. T.

Chemical analysis of several mineral waters from Oradea and from the Bihor district. G. GHIMICESCU and I. VARÓDI (Ann. Sci. Univ. Jassy, 1938, **24**, II, 134—140).—Data are summarised. L. S. T.

Analysis of mineral springs of Covasna (Trei-Scaune District). C. ŞUMULEANU, M. BOTEZATU, and A. VIERIU (Ann. Sci. Univ. Jassy, 1938, **24**, II, 15—24).—Physico-chemical data for, and chemical analysis of, H_2O from four mineral springs are recorded. L. S. T.

Water of the Ilidža thermal spring. S. MIHOLIĆ (Arh. Hemiju, 1938, **12**, 83—92).—Analytical data are recorded. R. T.

Evolution of emanation to running water from rocks containing radium. H. MACHE and G. MARKSTEIN (Sitzungsber. Akad. Wiss. Wien, IIa, 1935, **144**, 489—492; Chem. Zentr., 1936, ii, 951—952).—Measurements are recorded of the amount of emanation carried away by running H_2O from pitchblende of various grain sizes. The amount is independent of the rate of flow of H_2O. Dependence on grain size and temp. was apparent only in the early parts of the experiments. H. J. E.

Oxidation-reduction potential and p_H of sediments of the Barentz and Kara seas. S. V. BRUEVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 637—640; cf. Cooper, A., 1938, I, 81, 103).—Following a positional survey (Arctic expedition), measurements of redox potential (E_h) and p_H have been made, using Pt and quinhydrone electrodes, respectively, for the near-bottom H_2O and Mn- and Fe-rich sediments characterising the abyssal depths of the Polar basin. The brown (upper) is the primary deposit, ascribed to ice-borne weathered mineral. With the low org. content of Polar seas, its high state of oxidation is maintained by aq. aëration. The greyish (lower) layers of like silicate composition (Gorshkova) are derived by reduction by org. matter of the sunken brown layers; the liberated CO_2 forms H carbonates which diffuse upwards to be reoxidised. This view accords with (i) the absence of the brown deposits in the open southerly areas with ice-free H_2O of low [Fe] and containing plankton; (ii) the higher concn. of Mn, Fe_2O_3, and org. matter in the brown layer; (iii) the higher E_h of the brown layer (270 mv. as against 105—224 mv.), due solely to higher Mn oxides.

I. McA.

Colouring of Polar sea sediments. M. V. KLENOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 629—632).—A descriptive review of the geochemical evidence provided by, and precautions necessary in, the study of colour. Relevant results of the Papanin expedition are briefly analysed.

I. McA.

Potassium deposits of the southern basin of the Permian Sea and the salt lakes of Western Kazakhstan. N. S. KURNAKOV, I. N. LEPESCHKOV, D. I. RJABTSCHIKOV, and N. I. BUJALOV (Bull. Acad. Sci. U.R.S.S., 1938, Sér. Chim., 13—32).—The occurrence of deposits of K salts is reported.

E. S. H

Recent deposition of salt from Great Salt Lake. T. C. ADAMS (J. Geol., 1938, **46**, 637—646).—During the last four years pptn. of NaCl on the bed of the lake has occurred during the summer owing to the reduced vol. of H_2O then present. Re-dissolution has occurred in winter, when the well-known deposition of the Na_2SO_4 takes place owing to the fall in temp. A large tabular deposit of almost pure Na_2SO_4 lies buried in the beach sands along one shore of the lake and may be related in its formation to past winter pptn. similar to that now being observed. L. S. T.

Carotenoids in lacustrine silts. S. MURAVEISKI and I. CHERTOK (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 521—523; cf. Baudisch, A., 1935, 1180).—The xanthophyll and carotene contents of the dried silts from 10 lakes have been determined. Normally present only in traces or >100 μg. per g. of dried silt, in one instance amounts of 0·3—3·0 mg. per g. are found. Cryst. carotene, two monoketones akin to mixoxanthene and echinenone, two unidentified xanthophylls, and several other pigments spectroscopically akin to lutein have been extracted.

I. McA.

Neutrons of rocks. G. V. GORSCHKOV, N. M. LJATKOVSKAJA, A. G. GRAMMAKOV, and V. S. SHADIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 499—502; cf. La Cierva, A., 1937, I, 161).—Counter measurements have been made of the intensity of (fast) neutron emission from rock containing 0·2% U_3O_8 and from a Rn–Be prep. The rock emits ~1 neutron per 2000 γ-ray quanta.

I. McA.

Occurrence, crystal habit, and composition of the uraninite from the Ruggles Mine, near Grafton Centre, New Hampshire. B. M. SHAUB (Amer. Min., 1938, **23**, 334—341; cf. A., 1937, I, 588; 1938, I, 283).—The analysis [F. HECHT] is SiO_2 0·80, PbO 3·63 (Pb 3·37), Fe_2O_3 0·66, Al_2O_3 0·44, MnO 0·09, rare earths 0·21, ThO_2 0·43 (Th 0·38), U_3O_8 90·06 (U 76·38), CaO 0·81, MgO 0·17, P_2O_5 0·16, S 0·04, H_2O- 0·73, loss on ignition (100—1000°) 1·74, insol. 0·54, total 100·51%. L. S. T.

Crystal structure of the clay minerals, dickite, halloysite, and hydrated halloysite. S. B. HENDRICKS (Amer. Min., 1938, **23**, 295—301; cf. A., 1938, I, 484).—*X*-Ray diffraction data are discussed. Dickite has an at. arrangement based on space-group C_s^4—Cc. Independent layers of $[(OH)_4Si_2Al_2O_5]_n$ are superimposed in some random manner in which a shift of $(2n + 1)b_0/6$ of one layer with respect to another is maintained. Hydrated halloysite, $Al_2O_3,2SiO_2,4H_2O$, probably possesses a structure in which neutral $[(OH)_4Si_2Al_2O_5]_n$ layers similar to those of the other clay minerals are interleaved with $[2(H_2O)]_n$ layers. L. S. T.

Algæ as rock builders : algal limestones from Colorado. J. H. JOHNSON (Univ. Colo. Studies, 1936, **23**, 217—222).—A review. CH. ABS. (e)

Nickel in pumice stone. F. HEIDE (Naturwiss., 1938, **26**, 495).—Spectrographic analysis, confirmed by pptn. with dimethylglyoxime, indicates the presence of about 0·001% Ni in pumice stone from the Oetztal (Tyrol). This does not necessarily support the view that the rock is the remains of a meteoric crater as the mean [Ni] in volcanic rocks is about 0·01%. A. J. M.

Atomic arrangement and variability of members of the montmorillonite group. G. NAGELSCHMIDT (Min. Mag., 1938, **25**, 140—155).—*X*-Ray and optical data are given for three end-members montmorillonite $Si_2O_5,Al_2(OH)_2,Si_2O_5$, Mg-beidellite $Si_2O_5,Mg_3(OH)_2,Si_2O_5$, and nontronite $Si_2O_5,Fe_2(OH)_2,Si_2O_5$. Chemical analyses (from the lit.) of materials from the same localities are correlated with respect to a three-layered lattice. L. J. S.

Francolite from sedimentary ironstones of the Coal Measures. T. DEANS [with analysis

by H. C. G. Vincent] (Min. Mag., 1938, **25**, 135—139).—Minute (< 1 mm.) platy crystals of a mineral of the apatite group are found embedded in kaolin in oolitic ironstone at Robin Hood quarry near Leeds and at other places in the Yorkshire coalfield. They are optically biaxial (2V 25—40°), with α 1·620, β 1·627, γ 1·628, d 3·21. Analysis gave P_2O_5 38·25, CO_2 1·98, F 2·80, CaO 54·64, SrO 0·13, MgO trace, H_2O+ 0·66, H_2O- 0·06, insol. 2·19, total (less O for F) 99·53. Formula, $(Ca,Sr)_{10}(P,C)_6(F,OH)_2O_{24}$, with F : OH = 3 : 1. The formula of Gruner and McConnell (A., 1938, I, 52) is corr. to $(Ca,Mg,C)_{10}(P,V,C)_6F_2OH(O,F)_{23}$.
L. J. S.

Tabular spessartine crystals in muscovite. E. D. Mountain and L. E. Kent (Min. Mag., 1938, **25**, 125—134). L. J. S.

Withamite from Glen Coe, Scotland. C. O. Hutton (Min. Mag., 1938, **25**, 119—124).—Analysis of the pink, strongly pleochroic epidote, forming spherulitic growths in vesicles in an altered andesite, shows Mn_2O_3 0·96%, with d 3·39—3·40, α 1·733, β 1·750, γ 1·762. A gradation to piedmontite is suggested. L. J. S.

Potash-soda-felspars. II. Applications to petrogenesis. Edmondson Spencer (Min. Mag., 1938, **25**, 87—118; cf. A., 1937, I, 269).—Conditions of crystallisation and perthitic exsolution are discussed. A new equilibrium diagram suggests that a residual granite magma at about 800° in presence of much H_2O and free SiO_2 splits into soda-rich and potash-rich fractions, giving different types of pegmatites. L. J. S.

Crystalline rocks of Bistriţa, Doma-Broşteni region, Câmpulung and Neamţ districts. M. Savul (Ann. Sci. Univ. Jassy, 1938, **24**, II, 206—286).—Cryst. schists, limestones, etc. are described.
L. S. T.

Ores: from magmas or deeper? L. C. Graton (Econ. Geol., 1938, **33**, 251—286).—The views of Holmes (A., 1938, I, 163) are criticised (cf. also *ibid.*, 283). L. S. T.

Geology and origin of sulphur springs. K. A. Weithofer (Berg- u. Hüttenmänn. Monatsh., 1938, **86**, 89—97).—The probable chemical reactions involved in the formation of S springs, and the compositions and therapeutic val. of springs in the Alps and Hungary, are discussed. R. B. C.

Indian bauxite. I. Chromium and vanadium. S. C. Ganguli and J. Das-Gupta (J. Indian Chem. Soc., 1938, **15**, 243—244).—Of 15 samples of Indian bauxite, 14 contain 0·043—0·142% V_2O_5 and 0·030—0·125% Cr_2O_3 determined by Sandell's method (A., 1936, 1353); the remaining sample (from Kashmir) contained only 0·0025% V_2O_5 and 0·013% Cr_2O_3.
F. R. G.

Alunite. IV, V. Y. Asada (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 553—565; 566—593).—Sp. heat and ρ measurements have been made.
W. R. A.

Samarskite found in the placer of Rynjomen. S. Iimori and S. Hata (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 922—930).—The crystals of the mineral are orthorhombic prisms with pyramidal termination and sometimes tabular with edges and corners generally not sharp. The fracture is conchoidal and of velvet-black lustre; cleavage imperfect, streak dark reddish-brown, and hardness ~5·5—6·0. It is strongly radio-active, d 5·96—6·05. Specimens of lower d occur and they contain less U. A scheme of quant. analysis is given and from analytical data the formula $R^{II}_3R^{III}_2R^{IV}(Nb,Ta)_6O_{23}$ is assigned. The approx. age of the mineral, deduced from the Pb, Th, and U contents, is 134×10^6 years.
W. R. A.

Magnetic anisotropy and pleochroism of biotite mica. P. Nilakantan (Proc. Indian Acad. Sci., 1938, **8**, A, 39—60).—The paramagnetic anisotropy and susceptibility, the $Fe^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$ content, and the pleochroism of three varieties of biotite and one each of muscovite and phlogopite micas have been determined. The biotites are highly anisotropic; their anisotropy and pleochroism increase with increasing [Fe] and both depend only on the presence of $Fe^{\cdot\cdot}$ and not on $Fe^{\cdot\cdot\cdot}$. The anisotropy results are discussed on the basis of the theories of Van Vleck and of Penney and Schlapp and those on pleochroism on Saha's theory. A relationship between pleochroism and paramagnetic anisotropy is established. W. R. A.

Fluorescent ion of chromium in ruby.—See A., 1938, I, 495.

Fluorite in the Kungurian limestones and dolomites of the Ural–Emba region. V. P. Baturin (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 503—506).—Though the content of quartz and felspar is negligible, celestite admixed with ~2% of fluorite is present up to 3—20%. The petrology of these and other sedimentary deposits is discussed with reference to components, distribution, and origin. I. McA.

Primordial segregation of metals. J. S. De Lury (J. Geol., 1938, **46**, 756—763; cf. A., 1937, I, 587).—The associations of certain metals with certain igneous rocks are discussed and their fortuitous nature is emphasised. This fortuity and the general unevenness of the geographical distribution of metals are not satisfactorily explained by the current theory that most ore deposits of magmatic origin were derived by differentiation from the same parental magma that gave rise to contemporaneous and associated igneous rocks. The hypothesis now outlined of primordial differentiation of earth material with a consequent primitive segregation of metals eliminates these objections; it also explains the evidence provided by the at. wt. of Pb. L. S. T.

Mineralogical study of the metalliferous deposit of Pârâul Baia, Ditrău, Ciuc, Transylvania. V. Ianovici (Ann. Sci. Univ. Jassy, 1938, **24**, II, 439—456).—Metallisation of the nepheline syenite and the phyllitic schists has resulted in the deposition of pyrite, blende, galena, and chalcopyrite, which are described. The mineral succession and the origin of the deposit are discussed. L. S. T.

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

NOVEMBER, 1938.

Kramers' absorption law in physical problems. D. H. MENZEL (Nature, 1938, **142**, 433—434).—A criticism (cf. A., 1938, I, 423). An alternative interpretation of the spectrum of H in the discharge tube and in planetary nebulæ, which does not invalidate Kramers' law, is discussed. L. S. T.

After-effect electrons in the photo-effect in a non-self-maintaining hydrogen discharge. H. COSTA and H. RAETHER (Naturwiss., 1938, **26**, 593).—The fraction of the photo-effect due to after-effect electrons under the above conditions considerably exceeds that of other processes. A. J. M.

Band spectrum of helium. F. L. ARNOT (Nature, 1938, **142**, 536).—Recent work (A., 1938, I, 429) shows that the He mols. are formed after interruption of the discharge by the collision of a metastable with a neutral atom (cf. *ibid.*, 485). L. S. T.

Hyperfine structure of boron, yttrium, rhodium, and palladium. D. T. WILLIAMS and L. P. GRANATH (Physical Rev., 1938, [ii], **54**, 338—341).—Data for λλ, transition, and structure are reported for the spectra of B, Y, Rh, and Pd excited in an uncooled Schuler lamp for the range 2500—4000 A., in an attempt to find hyperfine structure. None was discovered that could be interpreted either as isotope shift or as structure due to a nuclear magnetic moment. N. M. B.

New Rydberg series in N_2. R. E. WORLEY and F. A. JENKINS (Physical Rev., 1938, [ii], **54**, 305).—The absorption spectrum of N_2 for 785—850 A. with high dispersion shows a converging series of band heads terminating at ~800 A., and constituting the higher and intermediate members of an electronic series the lower members of which confuse with the complex of bands at longer λλ. The frequencies of the heads closely follow a Rydberg law. The series limit lies at 125,670±2 cm.$^{-1}$, or 15·503 v., which is the first ionisation potential of N_2 computed by Mulliken (cf. A., 1936, 261). The limit of the series is the $^2\Sigma_g^+$ normal state having an internuclear distance 1·11 A. N. M. B.

New band of atmospheric oxygen. H. D. BABCOCK (Physical Rev., 1937, [ii], **51**, 148; cf. A., 1931, 1343).—Approx. 20 lines of the (1, 2) band, 6955—6996 A., with air-paths of approx. 100 km., have been measured. Known spacings of various energy levels in the mol. are shown by the new band. L. S. T.

New terms in the spectrum of Na III. D. H. TOMBOULIAN (Physical Rev., 1938, [ii], **54**, 347—350).—Full data and classifications are tabulated for the range 500—2600 A. of the spectrum excited by an electrodeless discharge, and 30 new levels arising from the $2s^22p^13p$, $2s^22p^13d$, and $2s^22p^14s$ configurations are established. N. M. B.

Presence of sodium in the atmosphere on the basis of interferometry of the *D*-line in the evening and night sky light. R. BERNARD (Z. Physik, 1938, **110**, 291—302; cf. A., 1938, I, 166, 285, 335, 423).—The yellow line of night sky light has λ = 5892·6 A. The Na is of terrestrial origin because the line does not appear in the spectrum of the northern lights. L. G. G.

Hyperfine structure in the resonance lines of Mg I and Mg II. R. A. FISHER (Physical Rev., 1937, [ii], **51**, 381).—Measurements of the structure obtained in the resonance lines 2852 A. of Mg I and 2803 and 2796 A. of Mg II, when an at. beam excited in an electrodeless discharge in A is employed as source, are recorded and discussed. L. S. T.

Arc spectrum of silicon. C. C. KIESS (J. Res. Nat. Bur. Stand., 1938, **21**, 185—205; cf. A., 1934, 231).—Redetermined λλ, wave-nos., intensities, and term combinations for 400 lines at 1565—12,270 A. are tabulated. The fine structure of some diffuse red and infra-red lines has been studied using an arc in N_2 at low pressure. The new and previously known singlet and triplet terms employed in the classifications give $3p^3P_0$ (65,743 cm.$^{-1}$) as the ground state of Si I, corresponding with an ionisation potential of 8·11 v. Observed and predicted lines at >3000 A. correspond in many cases with hitherto unidentified Fraunhofer lines. Data for 7 Si II lines are recorded. A. J. E. W.

Lithium I-like spectrum of phosphorus, P XIII. H. A. ROBINSON (Physical Rev., 1937, [ii], **51**, 381).—The Li I-like isoelectronic sequence has been extended to include P XIII. The second members ($2s$—$3p$) of the principal series lie at 35·137 and 35·098 A., respectively. Other transitions, such as $2p$—$3d$ and possibly $2p$—$2s$, have been located. The ionisation potential is ~608 e.v. L. S. T.

Four forms of the copper arc in air. A. S. FRY (Physical Rev., 1937, [ii], **51**, 63—64).—The main features of four distinct and reproducible forms which have been identified for the Cu arc in air at 1 atm. are recorded. The controlling gas in the first arc is N, and the gradient in the third and fourth arcs is determined by the presence of Cu vapour furnished by thermal decomp. of the oxides. L. S. T.

Nuclear magnetic moment of copper. S. TOLANSKY and G. O. FORESTER (Proc. Physical Soc., 1938, **50**, 826—833).—The Cu arc resonance lines

λ 3247 and 3274 were obtained sharp and free from reversal effects, the doublet separations being 379 and 405 × 10^{-3} cm.$^{-1}$, respectively. Hyperfine structure interval factors are calc. The mean nuclear magnetic moment is 2·47, and from the ratio of the magnetic moments of the two isotopes the vals. found for ^{63}Cu and ^{65}Cu are 2·43 and 2·54 nuclear magnetons, respectively. N. M. B.

K spectra of arsenic (33), selenium (34), and bromine (35). (MLLE.) M. L. ALLAIS (Compt. rend., 1938, **207**, 450—452).—The KM_{II}–KM_{III} ($\beta_1\beta_3$) doublets of As, Se, and Br have been resolved. Measured λλ of the β_1, β_2, and β_3 lines are recorded. A. J. E. W.

Spectra of Rb III and Sr IV. D. H. TOMBOULIAN (Physical Rev., 1938, [ii], **54**, 350—354).—By applying Shortley's equations (cf. A., 1933, 1226) to the $4s^24p^5(^2P^0)5p$ levels of Rb II, the separation of the ground levels $4s^24p^5\ ^2P^0$ of Rb III has been computed; the observed val. is 7380 cm.$^{-1}$ The $^2P^0$ separation of Sr IV has been predicted from the regular doublet law and identified from the data as 9731 cm.$^{-1}$ On the basis of transitions into the ground doublet, certain $4s^24p^14d$ and $4s^24p^15s$ levels have been located. N. M. B.

Modified scattered spectrum of characteristic molybdenum K radiation at large scattering angle with helium gas as the scattering substance using a curved quartz crystal spectrograph. H. A. KIRKPATRICK and J. W. M. DUMOND (Physical Rev., 1937, [ii], **51**, 147).—The first actual spectrum of Compton shifted radiation to be made with a gaseous scatterer has been obtained; it permits a comparison of the observed breadth and structure of the modified line with the predictions of DuMond's theory for an atom of sufficient simplicity to allow the electron momentum distribution to be calc. L. S. T.

New band systems of diatomic antimony. G. M. ALMY and H. A. SCHULTZ (Physical Rev., 1937, [ii], **51**, 62).—The spectrum of diat. Sb, obtained by heating Sb in N_2 in a graphite tube furnace, shows two new systems, in absorption at 1350—1600° and in thermal emission at 1550—1750°, extending from 4500 to 6000 A. and from 6000 to 7500 A. Both systems involve the ground state, the heat of dissociation of which is ~3·7 v. Consts. for the X, A, and B states are recorded. L. S. T.

Hyperfine structure perturbations in iodine due to nuclear quadrupole moment. S. TOLANSKY (Nature, 1938, **142**, 393).—Seven out of ten interval factors calc. from the hyperfine structure of the spark spectrum of I exhibit perturbation, the interval rule breaking down. The frequency of this indicates that it must arise from the existence of a nuclear quadrupole moment. The interaction energy for each perturbed level necessitates a cubic law to account for the observed vals. L. S. T.

Preliminary lists of terms for the arc and spark spectra of tungsten. D. D. LAUN (J. Res. Nat. Bur. Stand., 1938, **21**, 207—224).—λ and Zeeman effect measurements on ~500 lines at 2100—3100 A. are reported, intensities, wave-nos., and classifications being given. The low ^6D and ^6S terms of W II, with several unidentified metastable terms, are established; the raie ultime is probably at 2204·49 A. 89 new levels for W I have been found, and g vals. for 37 of these levels have been deduced from the Zeeman effect data. A. J. E. W.

Broadening of the wings of the mercury resonance line 2537 A. by increase of the pressure of mercury and of foreign gases. H. A. RÜHMKORF (Ann. Physik, 1938, [v], **33**, 21—51; cf. Kuhn, A., 1937, 1, 272).—Broadening has been investigated at Hg pressures up to 2400 mm., N_2, O_2, and CO_2 to 6 atm., and A at 1 atm. The absorption coeff. in all cases ∝ the no. of Hg atoms and the no. of foreign gas particles. Coupling broadening is not effective except near the centre of the line. Positions of diffuse bands characteristic of the added gas are measured. Optical collision cross-sections are calc. from the variation with foreign gas pressure of the absorption coeff., near the centre of the line. Van der Waals consts. are calc. O. D. S.

Broadening [of spectral lines] due to pressure and electron collision with the high-pressure mercury discharge in relation to the current density. R. ROMPE and P. SCHULZ (Z. Physik, 1938, **110**, 223—232).—The width of the lines 5770 A. ($2^1P_1 - 3^3D_2$) and 10,140 A. ($2^1P_1 - 2^1S_0$) in the high-pressure Hg discharge has been determined in relation to the c.d. The width of 3^3D_2 terms increases linearly with c.d.; 2^1P_1 terms show little variation with c.d. This indicates that broadening of 3^3D_2 terms arises from electron collisions while broadening of 2^1P_1 terms is a pressure effect. H. C. G.

Distribution of light intensity in the luminous arc of the high-pressure discharge in mercury vapour. F. RÖSSLER (Z. Physik, 1938, **110**, 352—359).—The intensity of certain Hg lines and of the continuous spectrum is measured with a monochromator the object focus of which travels across the axis of the discharge tube. For the lines, the max. intensity is in the centre of the tube, falling off to the sides, but with the continuous spectrum the curve has three max., viz., in the centre and at each tube-wall. The lateral max. are attributed to fluorescence. L. G. G.

Action cross-sections for impacts of the second type in excited mercury vapour; hyperfine structure of the 2537 A. mercury resonance line. O. BUHL (Z. Physik, 1938, **110**, 395—396; cf. A., 1938, I, 335).—A correction. H. C. G.

L-Satellites in the atomic number range $73 < Z < 79$. F. K. RICHTMYER, C. H. SHAW, and R. E. SHRADER (Physical Rev., 1937, [ii], **51**, 380).—Preliminary data on the intensities of the satellite group, relative to the parent line $L\alpha_1$, are recorded. L. S. T.

Electron temperature and light excitation in the gas discharge excited by short and ultra-short waves. W. NÖLLER (Z. Physik, 1938, **110**, 320—329).—The discrepancy in vals. obtained by the optical and electrical methods for the electron temp. in the high-frequency discharge in gases is explained mathematically by examination of the excitation function and electron velocity distribution. Comparison of the electron temp. in the He discharge with

short and with ultra-short waves is made from measurements of the relative intensities of spectral lines. H. C. G.

Characteristic quantities in the glow discharge with consideration of the [local] temperature rise. H. FISCHER (Z. Physik, 1938, **110**, 197—213).—The relation of the c.d., cathode voltage drop, and thickness of the dark space to the γ-coeff. and the ionic velocity is discussed theoretically. Gas density at a given point is more important than the pressure and in order to determine it the gas temp. must be known. Experimental work was performed in He at 1—5 mm. pressure. H. C. G.

Method of line reversal. H. J. HÜBNER (Ann. Physik, 1938, [v], **33**, 52—56).—Reversal temp. > the black-body temp. of the reversed radiation can be determined by extrapolation from measurements of the brightness of the reversed line. O. D. S.

Spectrum of the aurora and state of the auroral region. L. VEGARD (Naturwiss., 1938, **26**, 639—644).—A review of work on the variation and explanation of the spectrum of the aurora. A. J. M.

Photographic determination of height and spectra of the great aurora of Jan. 25—26, 1938. C. STÖRMER (Naturwiss., 1938, **26**, 633—638).—Photographs taken at Oslo and 7 other stations are discussed. A. J. M.

Are there metastable molecules in the Lewis-Rayleigh glow? J. KAPLAN (Physical Rev., 1937, [ii], **51**, 143—144).—Evidence that there are no metastable mols. in this glow is presented. L. S. T.

Existence of the bands 2963 and 2977 in night sky spectra. J. KAPLAN (Nature, 1938, **142**, 395).—Laboratory evidence supporting the reality of Gauzit's observation of these bands in the light of the night sky (A., 1935, 3) is presented. L. S. T.

Zeeman and Paschen-Back effects in strong magnetic fields. P. KAPITZA, P. G. STRELKOV, and E. LAURMAN (Proc. Roy. Soc., 1938, **A**, **167**, 1—15).—A method of investigating the effects in fields up to 320,000 gauss is described. The Zeeman splitting $\propto$ the magnetic field and obeys the theoretical predictions previously verified for weaker fields; no displacement of the centre of gravity of the splitting pattern was observed. The Paschen-Back effect was studied on a Be doublet and accurately followed theoretical predictions; its initial stages were also observed on a Zn triplet. G. D. P.

Hyperfine structure of the Zeeman components of the resonance lines of sodium. D. A. JACKSON and H. KUHN (Proc. Roc. Soc., 1938, **A**, **167**, 205—216).—The hyperfine structure was observed by means of absorption in an at. beam, the resolution being obtained by use of a double etalon. In strong fields four components are observed, showing that the nuclear spin is 3/2. The change of spacing of the lines with field strength is in good agreement with theory. Direct determination of the hyperfine structure of the terms $3S_{\frac{1}{2}}$ and $3^2P_{\frac{1}{2}}$ was made from the complete resolution of the line 5896. G. D. P.

Zeeman effect of tellurium. J. B. GREEN and R. A. LORING (Physical Rev., 1937, [ii], **51**, 62).—The Zeeman effect of Te has been investigated at field strengths of approx. 36,000 gauss. The spectrum of Te II was especially well excited, and j- and g-vals. have been assigned in many cases. L. S. T.

Pure Stark effect observed in metallic arcs. J. HURUITI and T. HORI (Nature, 1938, **142**, 535).—Under suitable arcing conditions, the Stark effect for certain lines of Fe, Cu, Ag, Ni, and Al has been observed. A photograph showing this effect in the 2317 and 2321 A. lines of Ag is reproduced. L. S. T.

Electric breakdown in gases. Y. MIYAMOTO (Res. Electrotech. Lab. Tokyo, 1935, No. 380, 111 pp.).—He, Ne, and A do not form negative ions, and the sparking potential of the needle-plate gap with needle positive is > that with it negative. H_2 and N_2 do not form negative ions, but O_2 and Cl_2 do so. Among gases with the same no. of atoms per mol., the lower is the first ionisation potential, the higher is the sparking potential in parallel-plate gaps. CH. ARS. (e)

Disintegration of a monatomic layer of thorium on a tungsten cathode in a mercury discharge. N. MORGULIS and M. BERNADINER (Tech. Phys. U.S.S.R., 1935, 2, 333—352).—The thermal evaporation theory of cathode disintegration does not explain the existence of a min. crit. ionic energy (V_0) required for disintegration. Experiments were carried out on the disintegration of a monat. Th film on a W filament bombarded by Hg^+ from a gaseous discharge in a tube provided with an auxiliary W cathode. In an ordinary two-electrode discharge the val. of V_0 varies with the temp. of the Th cathode. The variation of V_0 with discharge current with the Th cathode at 1600—1700° K., bombardment taking place with ions from the auxiliary W cathode, was also determined. V_0 decreases with increasing bombarding ion current, finally reaching a limiting val. of 13—18 v. The probability of disintegration increases rapidly with increase of ion energy. An expression connecting the crit. disintegration energy with the neutralising energy of the bombarding ion, its accommodation coeff., the energy of evaporation of the surface atom, and the amount of energy lost at impact with the next atom is derived, and agrees with experiment. A. J. M.

Mechanism of electron emission from coated cathodes. E. MESCHTER (Physical Rev., 1937, [ii], **51**, 377—378). L. S. T.

Secondary-electron emission from nickel, cobalt, and iron as a function of temperature. L. R. G. TRELOAR and D. H. LANDON (Proc. Physical Soc., 1938, **50**, 625—634).—A crit. discussion of evidence tends to discredit the view that magnetic and structural changes in ferromagnetic metals are accompanied by changes in the secondary-electron emission. Measurements of secondary-emission coeffs. for Ni, Co, and Fe at various primary voltages over a temp. range of ~400° show either no change or a slight fall in the coeff. with rising temp., an effect probably due to surface gas. There is no evidence of any discontinuous changes of secondary emission at the transformation points. N. M. B.

Alteration in electron liberation work through activation of oxide cathodes. W. HEINZE and S. WAGENER (Z. Physik, 1938, **110**, 164—188).—The change in work of electron liberation resulting from activation of oxide cathodes has been measured. The increase in emission resulting from activation is due solely to a decrease in the work done. The emission mechanism is discussed and it is concluded that of the inner and outer components of the liberation work, only the inner is affected by activation. H. C. G.

Wall potential of the diffusion column. W. FUNK and R. SEELIGER (Z. Physik, 1938, **110**, 271—276).—Theoretical. L. G. G.

Shenstone effect in bismuth. A. H. WEBER and C. B. BAZZONI (Physical Rev., 1937, [ii], **51**, 378).—Shenstone's experiments (Phil. Mag., 1923, **45**, 918) on the photo-electric sensitivity of Bi have been repeated and extended with two cast Bi plates and a Bi single crystal. The effect reported by Shenstone has been verified. Variations in this sensitivity of Bi when electric currents are passed through the metal directly are due to changes in the amount of gas occluded by the metal. L. S. T.

Quantum absorption probability in the case of the photo-electric effect. A. T. WATERMAN (Physical Rev., 1937, [ii], **51**, 378). L. S. T.

Stopping of fast electrons. A. BRAMLEY (Physical Rev., 1937, [ii], **51**, 387).—Energy losses suffered by electrons are discussed. L. S. T.

Direct proof of the effect of temperature on the conduction electrons of a metal. H. W. B. SKINNER (Nature, 1938, **142**, 432—433).—Photometric curves showing changes in the breadth of the edge of the L_{23} band of Al at 171 A. at 110°, 300°, and 680° K. are reproduced. The change between the lower temp. can be explained by the heat effect on the conduction electrons, but the additional broadening at 680° K. may be due to distortion of the lattice near the m.p. L. S. T.

Scattering and loss of energy of fast electrons and positrons in lead. W. A. FOWLER and (MISS) J. OPPENHEIMER (Physical Rev., 1938, [ii], **54**, 320—324).—A cloud-chamber investigation was made of the scattering and energy loss in a thin Pb lamina of fast electrons and positrons (5—17 Me.v.) produced as secondaries by the γ-radiation from $^7Li + {}^1H$. Scattering-angle curves show good agreement for angles >13° with the Mott–Rutherford theory of single scattering, and indicate multiple scattering below 13°. Comparative theoretical and observed energy losses are discussed. N. M. B.

Momentum transfer during ionisation by canal rays. R. KOOPS (Ann. Physik, 1938, [v], **33**, 57—69).—The total ionisation produced in D_2 and in He by H^+ and D^+ particles of velocities from 2000 to 17,500 e.v. has been measured. The total ionisation in D_2 is > in H_2, the abs. difference being const. The energy transfer to the atom on ionisation is $<2 \times 10^{-4}$ of the total energy change on collision. The energy balances for H_2 and for D_2 differ only for collisions of energy <2000 e.v. O. D. S.

Velocity analysis of potassium atoms scattered by a magnesium oxide crystal. V. W. COHEN and A. ELLETT (Physical Rev., 1937, [ii], **51**, 65).—The scattering that results when a beam of neutral K atoms with approx. thermal velocities characteristic of the temp. of the source is directed toward a MgO crystal is adequately described by the cosine law; neither specular reflexion nor any evidence of diffraction is observed. Magnetic analysis of the atoms scattered at right angles to the initial direction shows that the velocity distribution is Maxwellian and characteristic of the temp. of the crystal. The process is probably one of adsorption and re-evaporation, with the adsorbed atoms attaining thermal equilibrium with the crystal surface. L. S. T.

Stern–Gerlach magnetic field as a velocity analyser for atomic beams. A. ELLETT and V. W. COHEN (Physical Rev., 1937, [ii], **51**, 64—65).—The deflexion pattern of a beam of alkali-metal atoms traversing an inhomogeneous magnetic field has been examined in order to determine the constancy of the gradient and the validity of the Maxwell distribution. L. S. T.

Positive ion mobilities in hydrogen by the Townsend deflexion method. A. V. HERSHEY (Physical Rev., 1937, [ii], **51**, 146—147).—The mobility const. found for ions, presumably K^+, of mol. wt. 39 is 13·5 at 0·7 mm. pressure and $X/p = 5$ (X = field strength), in agreement with vals. obtained by Powell and Brata (A., 1932, 1185). At 0·7 mm. pressure and $X/p = 50$, the mobility const. is 30% greater. L. S. T.

Determination of the cross-section of metastable helium atoms with the aid of their "photo-electric" effect. R. DORRESTEIN and J. A. SMIT (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 725—730).—The cross-section (a) of metastable He atoms for collision with normal He atoms has been determined by measurement of the decrease in intensity of a beam of metastable atoms in passing through He at low pressures, this intensity being deduced from their effect in producing electron emission from a metal electrode. Measurements at const. pressure (9×10^{-4} mm.) and with const. electrode distance lead to vals. of a of 21×10^{-16} cm.^{2} and 18×10^{-16} cm.^{2}, respectively. J. W. S.

Atomic masses of hydrogen, helium, carbon, and nitrogen isotopes. K. T. BAINBRIDGE and E. B. JORDAN (Physical Rev., 1937, [ii], **51**, 384—385).—The mass separations CH_4–O, H_2–D, and D_3^+–C^{++} give H 1·00815±0·00002, D 2·01478±0·00003, and C 12·00428±0·00017. The doublet separation D_2–He gives He 4·00395±0·00007, and earlier measurements (A., 1937, I, 542) yield ^{13}C 13·0079±0·0002, ^{14}N 14·0076±0·0002, and ^{15}N 15·0050±0·0003. The doublet $^7Li^+$–$^{14}N^{++}$ gives ^7Li 7·01822±0·00014. L. S. T.

Existence of ^3H. R. SHERR, L. G. SMITH, and W. BLEAKNEY (Physical Rev., 1938, [ii], **54**, 388).—Mass-spectroscopic investigation of the fractionated decomp. products of very pure D_2O gave persistent evidence of an unexplained primary mass 5 ion, but no indication of mass 3. The abundance of ^3H in $^1H_2$ must be <1 in 10^{12}. N. M. B.

Atomic masses of beryllium, boron, neon, and argon. E. B. JORDAN and K. T. BAINBRIDGE (Physical Rev., 1937, [ii], **51**, 385).—The mass differences of 12 doublets calc. from mass-spectrographic lines are recorded. These differences and those reported previously (A., 1937, I, 542) give ^{12}C 12·00402±0·00017, ^{10}B 10·01633±0·00013, ^{20}Ne 19·99917±0·00019, ^{11}B 11·01295±0·00013, ^{9}Be 9·01517±0·00016, ^{40}A 39·97580±0·00031, ^{22}Ne 21·99870±0·00040, and ^{21}Ne 21·00013±0·00029 mass units. L. S. T.

Mass-spectrographic measurement of the C$^+$ band resulting from the dissociation of CO$^+$. K. T. BAINBRIDGE and E. B. JORDAN (Physical Rev., 1937, [ii], **51**, 595).—Using $^2D_2{}^1H$ and trebly-ionised O for comparison masses, a val. of 5·145±0·002 mass units has been obtained for the position of the C$^+$ band. This agrees with the calc. val., and not with the val. 5·18 reported by Aston. L. S. T.

Isotopic constitution of strontium, barium, bismuth, thallium, and mercury. A. O. NIER (Physical Rev., 1938, [ii], **54**, 275—278).—Using a mass spectrometer of high sensitivity and resolving power (cf. A., 1938, I, 168), no new isotopes were found. Relative abundances were: ^{88}Sr 100, ^{87}Sr 8·50, ^{86}Sr 11·94, ^{84}Sr 0·68; ^{138}Ba 100, ^{137}Ba 15·8, ^{136}Ba 10·9, ^{135}Ba 9·2, ^{134}Ba 3·37, ^{132}Ba 0·136, ^{130}Ba 0·141 (cf. Sampson, A., 1936, 1313). The Tl 203/205 ratio was 0·410±2%. Upper abundance limits of predicted or hypothetical isotopes are given. N. M. B.

Isotopes and analytical standards. M. G. MELLON (J. Chem. Educ., 1938, **15**, 335).—A correction (cf. A., 1938, I, 426). L. S. T.

Are there any naturally radioactive elements still unknown? J. SCHINTLMEISTER (Österr. Chem.-Ztg., 1938, **41**, 315—321).—The curves connecting mass nos. of nuclei emitting α-rays and their disintegration energies are discussed. These form a series of smooth curves from which predictions can be made regarding the α-radioactivity of Ms-Th_2 and Ac. The unknown element 87 must be produced by the α-disintegration of these nuclei, but such radiation has not yet been discovered. It is shown that the final member of the series of β-radiating nuclei obtained by Hahn *et al.* by the addition of neutrons to U (probably eka-Au) cannot be an α-radiator. The radiator of α-rays of range 1·8 cm. is probably an eka-Ti, of which the disintegration product must be a stable eka-Au. A. J. M.

Natural β-radioactivity of lutecium. M. HEYDEN and W. WEFELMEIER (Naturwiss., 1938, **26**, 612).—A counter tube has been constructed for the detection of β-rays of small intensity, and has been used for detecting the radioactivity of Lu. A purified prep. containing 90% Lu_2O_3 was found to have a weak β-activity, somewhat more intense than that of K, but < that of Rb. Tm is inactive, showing that the deviation of its at. wt. from an integral val. is not due to the presence of an isotope of higher mass no. which is β-radioactive. Yb and Ho preps. showed no activity >0·03 that of Lu. A. J. M.

Continuous β-ray spectrum of ^{32}P. W. E. LAMB, jun. (Physical Rev., 1937, [ii], **51**, 145). L. S. T.

Calculations on β-ray spectra. W. G. POLLARD (Physical Rev., 1937, [ii], **51**, 682). L. S. T.

Search for γ-rays from the deuteron–deuteron reaction. A. J. RUHLIG (Physical Rev., 1938, [ii], **54**, 308).—Evidence of the formation of ^3He in an excited state at ~2 Me.v. above the ground state, as shown by a second group of neutrons from the reaction $^2H + {}^2H \rightarrow {}^3He + {}^1n$ (cf. Bonner, A., 1938, I, 339), leads to the expectation of γ-rays due to the transition of ^3He to its normal state. Experiments to detect these γ-rays are described, and results indicate that there is ≯ one γ-ray for every 200 neutrons. Protons of energy >15 Me.v. due to neutrons, probably from the secondary reaction $^3He + {}^2H \rightarrow {}^4He + {}^1n + 17{\cdot}6$ Me.v. due to recoiling ^3H nuclei from the reaction $^2H + {}^2H \rightarrow {}^3H + {}^1H$, are reported. N. M. B.

Observation of ^1H and ^3H ranges from the disintegration of deuterium by deuterons. E. HUDSPETH and T. W. BONNER (Physical Rev., 1938, [ii], **54**, 308—309).—Experiments are described to detect a short-range group of protons from the reaction $^2H + {}^2H \rightarrow {}^3H + {}^1H$ in expectation of an excitation level in ^3H analogous with the 1·89 Me.v. level in ^3He. It is concluded that ^3H is excited to a level 0·4—2·9 Me.v. in <2% of the disintegrations, if at all. Measurements of the range of the ^3H particles produced in the same reaction indicate a need for revision of the range-energy relation for protons. N. M. B.

Bombardment of palladium with deuterons. J. D. KRAUS and J. M. CORK (Physical Rev., 1937, [ii], **51**, 383).—The active isotopes formed when Pd is bombarded with 6·5-Me.v. deuterons have been investigated. Chemical separations show strong activities in the Pd and at least two active Ag isotopes. The Ag activity is not the Fermi activity that would result from the bombardment of Ag itself (22 sec. and 2·3 min.), but has half-life periods of 32 min. and 7·5 days. L. S. T.

Method of studying a statistical theory of an exponential type. Application to radioactivity. M. FERBER (J. Phys. Radium, 1938, [vii], **9**, 337—344).—A new method is developed theoretically for studying statistical series of the exponential type, and has been applied to the automatic registration of α-particles emitted by Po. Fair agreement has been found with experimental data. A possible interpretation of certain anomalies is advanced. W. R. A.

Anomaly in the apparent absorption of slow neutrons by iodine and boron. J. L. MICHIELS (Nature, 1938, **142**, 431—432).—Slow neutrons (Rn + Be + wax) are anomalously absorbed in B and I filters, and when these are used simultaneously, the activity produced in the detector depends on the order in which the filters are placed. An interpretation of the results is given. L. S. T.

Disintegration of boron by slow neutrons. C. O'CEALLAIGH and W. T. DAVIES (Proc. Roy. Soc., 1938, **A, 167**, 81—98).—The disintegration is studied

in a cloud chamber, the B being spread on a strip of thin Cu foil stretched diametrically across the chamber. Three groups of particles are observed with ranges of 4·25, 7·15, and 8·9 mm. in air at 15° and 760 mm. The first is due to the Li nucleus produced in the reaction $^{10}_{5}B + ^{1}_{0}n \rightarrow ^{7}_{3}Li + ^{4}_{2}He + Q_1$. The two longer-range particles are α-particles with energies deduced from their measured ranges of 2·45 and 3×10^6 e.v. The val. of Q_1 calc. from the equation of reaction is $2·99 \times 10^6$ e.v. It is concluded that the 8·9-mm. α-particles correspond with the production of the ^{7}Li nucleus in the ground state, and the 7·15-mm. particles with an excited nucleus.

G. D. P.

Absorption of resonance neutrons. H. H. Goldsmith and J. H. Manley (Physical Rev., 1937, [ii], **51**, 382).—Preliminary results obtained from measurements of the absorption of various neutron groups in Cd, Rh, and Ir are reported. L. S. T.

Neutron resonance levels of iridium and rhodium and the comparative overlapping of their resonance regions. R. Jaeckel (Z. Physik, 1937, **110**, 330—333).—The half-life periods of bodies produced by impact of slow neutrons on Ir have been measured by absorption in Rh. H. C. G.

Determination of the mass of the neutron from the nuclear photo-effect in heavy water. G. Stetter and W. Jentschke (Z. Physik, 1938, **110**, 214—222).—From the nuclear process $^{2}_{1}H + h\nu = ^{1}_{1}H + ^{1}_{0}n + E_{\text{Kin.}}$ (using the hard Th-C'' γ-radiation of 2·62 Me.v.), and the energy of production of ions in H_2 (determined by means of short H-radiation), the binding energy of deuterons is calc. as 2·189±0·022 Me.v. and the mass of the neutron as 1·00895± 0·00003. Reasons for discrepancies between these vals. and those of other authors are discussed.

L. G. G.

Neutron-yield curves for light elements. L. R. Hafstad and M. A. Tuve (Physical Rev., 1937, [ii], **51**, 376).—These curves have been obtained for several light elements bombarded with deuterons. The abs. no. of neutrons produced in the range 200—1000 kv. has been determined. L. S. T.

Neutron scattering cross-sections of *para*- and *ortho*-hydrogen, and of N_2, O_2, and H_2O. F. G. Brickwedde, J. R. Dunning, H. J. Hoge, and J. H. Manley (Physical Rev., 1938, [ii], **54**, 266—275).—Measurements were made of the transmission of liquid *p*- and *o*-H_2, for the slow neutrons obtained from a Rn–Be source, by scattering in paraffin at room temp. and at liquid air temp. The scattering cross-section σ of liquid H_2 for slow neutrons depended on the velocity of the neutrons and the *o*–*p* composition. The vals. obtained for σ were: *o*-H_2 56×10^{-24}, *p*-H_2 29×10^{-24} for ~300° K. neutrons (paraffin at room temp.); *o*-H_2 79×10^{-24}, *p*-H_2 18×10^{-24} sq. cm. per mol., for ~120° K. neutrons (paraffin cooled with liquid air). It was proved that the interaction between neutrons and protons depends on the relative alignment of their spins, and that the energy of the singlet state of the deuteron, in which the spins of the proton and neutron are antiparallel, is > the energy of these particles when far apart, *i.e.*, the singlet state of the deuteron is virtual (cf. Schwinger, A., 1937, I, 543). Other determinations of σ were: for O 4×10^{-24}, N 13×10^{-24} sq. cm. per atom, and H_2O $91·2 \times 10^{-24}$ sq. cm. per mol. for 300° K. neutrons; H_2O 116×10^{-24} for 120° K. neutrons; for the protons in H_2O, $0·5[\sigma(H_2O) - \sigma(O)]$, $43·6 \times 10^{-24}$ sq. cm. per proton for 300° K. neutrons and 56×10^{-24} for 120° K. neutrons.

N. M. B.

Capture cross-sections for 220-ke.v. neutrons. H. von Halban, jun., and L. Kowarski (Nature, 1938, **142**, 392—393).—The capture cross-sections of 20 elements for 220-ke.v. neutrons have been determined by surrounding the source of photo-neutrons (γ-rays of Th-C'' in D_2O) with a cylinder of the element to be investigated. The results show considerable variations even for neighbouring nuclei, the nuclei showing the largest cross-sections being identical with those showing large cross-sections for slow neutron capture, and having mainly odd proton nos. and even neutron nos. L. S. T.

Investigations with rapid neutrons.—I. Artificial neutron source and yield of D + D neutrons. H. Reddemann (Z. Physik, 1938, **110**, 373—388).—A discharge tube for the production of rapid corpuscular rays is described in detail. The yield of neutrons from the D + D reaction and the action cross-section of this reaction in relation to the deuteron energy have been examined over the range 0·1 to 1·0 Me.v. H. C. G.

α-Particle yield from protons on lithium. L. J. Haworth and L. D. P. King (Physical Rev., 1937, [ii], **51**, 59).—The yields of 8-cm. α-particles produced when thin and thick films of metallic Li are bombarded with protons have been determined as a function of proton energies from 20 to 200 kv. The $V^{\frac{3}{2}}$ absorption law is probably invalid at these low energies. L. S. T.

Gamma spectrum of ^{7}Be. H. Maier-Leibnitz (Naturwiss., 1938, **26**, 614).—The energy distribution of photo- and recoil electrons emitted from Pb by irradiation with γ-rays from $^{7}_{4}Be$ has been determined. The curve shows the presence of a single γ-line at 425±20 e.kv. A. J. M.

New radioactive isotope of fluorine. A. H. Snell (Physical Rev., 1937, [ii], **51**, 143).—Bombardment of Ne with 5-Mv. deuterons gives an active product which emits positive electrons and decays with a period of 112±4 min. It behaves chemically like F and must be ^{18}F. The reaction is $^{20}_{10}Ne + ^{2}_{1}D \rightarrow ^{18}_{9}F + ^{4}_{2}He$, and in decaying $^{18}_{9}F$ goes to stable ^{18}O. The positrons have a max. energy of approx. 500 kv.

L. S. T.

Radioactivity induced in calcium under deuteron bombardment. H. Walke (Physical Rev., 1937, [ii], **51**, 143).—Bombardment of calcite crystals with 5·5-Mv. deuterons renders them strongly radioactive. Several decay periods have been observed, and chemical analyses indicate that most of the activity is due to Sc isotopes, possibly ^{41}Sc, ^{43}Sc, and ^{44}Sc. L. S. T.

Bombardment of gold with deuterons. J. M. Cork and R. L. Thornton (Physical Rev., 1937, [ii], **51**, 59).—Bombardment of Au with 6—7-Me.v.

deuterons gives a radioactivity associated with a Au and an Ir isotope. The Au emits negative electrons and the Ir both positives and negatives. Probable reactions are $^{197}_{79}Au + ^{2}_{1}H \rightarrow ^{198}_{79}Au + ^{1}_{1}H \rightarrow ^{198}_{80}Hg + ^{1}_{1}H + ^{0}_{-1}e$; and $^{197}_{79}Au + ^{2}_{1}H \rightarrow ^{194}_{77}Ir + ^{1}_{1}H + ^{4}_{2}He$, $^{194}_{77}Ir \rightarrow ^{194}_{78}Pt + ^{0}_{-1}e$ and $^{194}_{76}Os + ^{0}_{+1}e$. L. S. T.

Induced radioactivity in lead. R. L. THORNTON and J. M. CORK (Physical Rev., 1937, [ii], **51**, 383).—Bombardment of Pb by 2 μ-amp. of deuterons at 6·5 Me.v. for approx. 12 hr. gave no definite indication of Ra-*D*. Active ^{209}Pb with a half-life period of 3·0 hr. and emitting β-particles is produced. Other shorter period activities have been observed but have not yet been resolved chemically. L. S. T.

Scattering of Yukawa particles by protons. O. LAPORTE (Nature, 1938, **142**, 432).—In contrast to electrons, Yukawa particles show a polarisation effect. L. S. T.

Nuclear disintegrations accompanying cosmic-ray showers. A. BRAMLEY (Physical Rev., 1937, [ii], **51**, 385).—A discussion. L. S. T.

Cosmic-ray bursts photographed with a cloud machine controlled by non-collinear counters. G. L. LOCHER (Physical Rev., 1937, [ii], **51**, 386).—The disintegration products of cosmic-ray bursts in paraffin, Al, and Pb have been investigated. L. S. T.

Radio-transmitted coincidence counter measurements of cosmic-ray intensities in the stratosphere. T. H. JOHNSON (Physical Rev., 1937, [ii], **51**, 385—386).—The method used is described. During an ascent of 55,000 ft., the cosmic-ray intensity passed through a max. equal to approx. 60 times the ground intensity. L. S. T.

Transition effects of cosmic rays in the atmosphere. R. SERBER (Physical Rev., 1938, [ii], **54**, 317—320).—A more exact calculation of the multiplication of the soft component of cosmic rays is made with the help of diffusion equations obtained from the high-energy radiative formulæ of Bethe and Heitler. Comparison of results with vertical counter and ionisation chamber data shows good agreement with observation for the position of the max. of the multiplication curve, and that the penetrating component is largely of secondary origin. N. M. B.

Nature of primary cosmic radiation. T. H. JOHNSON (Physical Rev., 1938, [ii], **54**, 385—387).—A discussion of the known properties and characteristics of cosmic rays leads to a theory tracing the origin of the rays to an unspecified process in stellar atm. N. M. B.

Decrease of intensity of cosmic rays in water to a depth of 440 m. measured with counters and ionisation chamber. J. CLAY, A. VAN GEMERT, and P. H. CLAY (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 694—705).—A plot of log intensity–log depth for cosmic rays in H_2O gives a straight line for depths >50 m. The vals. for 0—10 m. do not lie on this line and those for 10—50 m. also deviate slightly. The energy distribution curve of the hard component of cosmic radiation is deduced. Some irregularities are observed, owing to the excess of secondary rays at >200 m. and particularly at 280—400 m. J. W. S.

Distribution of the intensity of cosmic radiation for different directions around the vertical. J. CLAY, J. T. WIERSMA, and K. H. J. JONKER (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 706—708).—Measurements have been made with double counters in E–W and N–S directions, with and without 30 cm. of Pb between the counters. Without Pb the same val. is obtained in each direction, almost $\propto \cos^2 \alpha$ (α = angle of inclination to the vertical). With the Pb present deviations were observed, but these were eliminated by placing a horizontal layer of 30 cm. of Pb over the counters. The results are discussed with reference to the absorption of cosmic rays by the atm. and by H_2O. The coeff. of decrease of intensity of lateral rays is < that for vertical rays. J. W. S.

Ray multiplication in showers. H. GEIGER and M. HEYDEN (Z. Physik, 1938, **110**, 310—319).—Using a counter-tube coincidence method, it was found that the no. of coincidences recorded for a shower increased with increasing thickness of Pb, reaching a max. with 3 cm. of Pb and thereafter diminishing. A similar result was obtained with Al. Results are discussed and it is shown that the increase in the no. of coincidences is due to an increase in the no. of rays in a shower. H. C. G.

Cosmic-ray ionisations under various thicknesses of lead shield in northern and equatorial latitudes at different altitudes. R. T. YOUNG, jun., and J. C. STREET (Physical Rev., 1937, [ii], **51**, 386). L. S. T.

Search for exchange phenomena in cosmic rays. (MISS) Z. WASIUTYŃSKA and L. WERTENSTEIN (Nature, 1938, **142**, 475—476).—A search for evidence of proton–neutron exchange phenomena in cosmic rays, using five counters separated by different thicknesses of air and Pb, indicates that if the particles forming the bulk of the penetrating component give rise to any exchange effect, the mean free path in Pb for this effect is ⩾30 cm. The relative no. of protons present in cosmic penetrating radiation is very small. L. S. T.

Hard and soft component of cosmic radiation in terms of a common primary background. W. F. G. SWANN (Physical Rev., 1938, [ii], **54**, 307).—Fundamental assumptions on the basis of which expressions have been developed for the intensities of the primaries and secondaries are propounded and applied. N. M. B.

Production of penetrating secondary cosmic-ray particles in the atmosphere. M. SCHEIN and V. C. WILSON (Physical Rev., 1938, [ii], **54**, 304—305).—Hsiung-type experiments (cf. A., 1934, 1285) at high altitudes indicate that above 20,000 ft. penetrating ionising rays (heavy electrons) are produced by non-ionising agents (photons). Results agree with the assumption that the heavy electrons are formed by secondary photons abundant at high altitudes and strongly absorbed by 2 cm. of Pb. At 25,000 ft. the ratios, compared with sea-level, were

3 : 1 for the vertical penetrating component and 12 : 1 for the total vertical radiation. N. M. B.

Absorption of the penetrating component of cosmic radiation. W. M. NIELSEN and K. Z. MORGAN (Physical Rev., 1938, [ii], **54**, 245—248).—Geiger–Müller counter measurements inside and outside a cavern below rock of 60 m. H_2O equiv. depth indicate that the penetrating component is associated with an ionising particle and undergoes a hardening on transmission through large thicknesses of material. There is evidence that the less penetrating radiation is in approx. equilibrium with the penetrating component even at the earth's surface. N. M. B.

Energy distribution analysis of primary cosmic rays. A. H. COMPTON (Physical Rev., 1937, [ii], **51**, 59).—An analysis following Zanstra's method and using new latitude-effect data has been made. Between 9 and 19×10^9 e.v. the energy spectrum appears continuous and indicates an electrical particle origin of most of the cosmic-ray ionisation. L. S. T.

Absorption of corpuscles in the ionosphere. H. D. RATHGEBER (Naturwiss., 1938, **26**, 563).—The assumption that the absorption of ultra-radiation beyond the atm. is due to the presence of free electrons in the ionosphere is examined. The retarding effect calc. on this basis is too small to account for the observed absorption, and the hypothesis also fails to explain the observed variation of intensity. A. J. M.

Quantum theory and relativity. G. WATAGHIN (Nature, 1938, **142**, 393—394).—Theoretical. L. S. T.

Formation of deuterons by proton combination. H. A. BETHE and C. L. CRITCHFIELD (Physical Rev., 1938, [ii], **54**, 248—254).—Mathematical. The probability of the reaction $H + H = D + \epsilon^+$ is calc. The energy evolution due to the reaction is about 2 ergs per g. per sec. at the centre of the sun and is almost sufficient to explain the observed average energy evolution of the sun. N. M. B.

Production of heavy electrons. L. W. NORDHEIM and G. NORDHEIM (Physical Rev., 1938, [ii], **54**, 254—265).—Mathematical. Estimates based on the close analogy of the barytron (heavy electron) theory of nuclear forces to the theory of the electromagnetic field are given for the probabilities of the processes leading to the production of barytrons. The theoretical cross-sections are too small to explain the properties of the hard component of cosmic radiation. The lifetime of barytrons, estimated from radiative β-decay, is $\sim 10^{-8}$ sec. No simple picture of barytron production in terms similar to radiation theory can be given, but the failure indicates only the inapplicability of perturbation calculations. N. M. B.

New experimental evidence for the neutrino. (A) L. WERTENSTEIN. (B) H. R. CRANE and J. HALPERN (Physical Rev., 1938, [ii], **54**, 306—307; cf. A., 1938, 1, 383).—(A) The uncertainty in assuming that the relation between the energy of an atom (recoiling ^{38}A) and the ionisation produced by the atom can be used to infer simultaneous emission of an electron and neutrino is emphasised.

(B) A discussion of the objections raised above, and of the problem of ionisation and interpretation of clusters of droplets in a cloud chamber. It is shown that the conclusions were arrived at by a comparison of ^{38}Cl, ^{32}P, and ^{13}N, rather than by an abs. estimate of recoil energy, and that a possible mechanism in addition to ionisation exists for the production of droplets by slowly moving atoms. N. M. B.

Magnetic deflexion of HD molecules. I. ESTERMANN, O. C. SIMPSON, and O. STERN (Physical Rev., 1937, [ii], **51**, 64).—The magnetic deflexion of mol. beams of HD shows that HD differs from H_2 and D_2 by the absence of mols. with zero moment. The weakening by the magnetic field at the position of the undeflected beam is nearly independent of the magnetic moment of the deuteron and of the rotational magnetic moment, but is sensitive to the moment of the proton, more than in the case of H_2. L. S. T.

Sub-elements. F. P. WORLEY (J. New Zealand Inst. Chem., 1938, **3**, 52—53).—A discussion of the possible existence of elements of at. mass <1, possessing nuclei composed of positrons and electrons. Such elements may occur as nuclear disintegration products, in cosmic rays, and among the products of sun-storms which cause terrestrial electromagnetic disturbance. A. J. E. W.

Creation of pairs by nuclear electrons. J. K. KNIPP (Physical Rev., 1937, [ii], **51**, 381—382). L. S. T.

Dimensionless constants of physics. A. E. HAAS (Proc. Nat. Acad. Sci., 1938, **24**, 274—276).—Theoretical. The ratio of the total no. of neutrons to the total no. of protons in the universe is 1 if the results of Eddington and Sitte *et al.* based on wave-mechanics are correct. A. J. M.

Charge on the electron. J. A. BEARDEN (Physical Rev., 1937, [ii], **51**, 378).—A redetermination of the η of air by the rotating-cylinder method gives a val. which, taken with Millikan's oil-drop data, yields for e a val. in agreement with that obtained from X-ray measurements. L. S. T.

Precision determination of h/e from the short wave-length limit of the continuous X-ray spectrum. V. L. BOLLMAN and J. W. M. DU MOND (Physical Rev., 1937, [ii], **51**, 145).—Two precision determinations of the short-λ limit of the continuous X-ray spectrum made in the regions of 10^4 and 2×10^4 v., respectively, give $h/e = 1{\cdot}3767 \times 10^{-17}$. The results confirm the discrepancy in certain physical consts. emphasised by Birge. Accepted vals. of F are suspected. L. S. T.

Measurement of the velocity of light. W. C. ANDERSON (Physical Rev., 1937, [ii], **51**, 596).—A high-frequency method using a relatively short base line gives from 651 measurements a mean val. of 299,764 km. per sec. in a vac. L. S. T.

Matrix element in the Fermi theory of β-decay. L. W. NORDHEIM (Physical Rev., 1937, [ii], **51**, 64).—The way in which the many-body constitutions of the nuclei have to be taken into account in this theory is discussed. L. S. T.

Classical theory of radiating electrons. P. A. M. DIRAC (Proc. Roy. Soc., 1938, **A**, **167**, 148—169).—A self-consistent scheme of equations is deduced which yield all the experimental results about the interaction of electrons and radiation. The physical interpretation of the equations indicates that the interior of the electron is a region of space through which signals can be transmitted with a velocity > that of light. G. D. P.

Loss of energy by fast particles in nuclear collisions. E. J. WILLIAMS (Nature, 1938, **142**, 431).—The energy lost by fast-moving particles in nuclear collisions when traversing matter is estimated to be the same as if the nuclear particles were free and isolated. L. S. T.

Interaction between light nuclei. M. PHILLIPS, L. EISENBUD, and E. U. CONDON (Physical Rev., 1937, [ii], **51**, 382).—The scattering cross-sections for neutrons or protons on $^{2}_{1}$H, $^{3}_{1}$H, $^{3}_{2}$He, and $^{4}_{2}$He, and for deuterons on deuterons, have been calc. Considerations based on ordinary forces and unsymmetrised wave functions yield elastic scattering cross-sections in approx. agreement with existing experimental data. L. S. T.

Interaction of heavy and light particles at very high energies. L. W. NORDHEIM and G. NORDHEIM (Physical Rev., 1937, [ii], **51**, 379).—Estimation of the probabilities of the emission of electrons and neutrinos by very energetic protons passing through matter, due to Fermi interaction, has been attempted. L. S. T.

Angular distribution of resonance disintegration products. R. D. MYERS (Physical Rev., 1938, [ii], **54**, 361—367).—Mathematical. Formulæ for general coupling and Russell–Saunders coupling are developed, and it is found that the distribution is axially symmetric about the direction of the incident particle and about the equatorial plane. Results are applied to the reactions: $^{2}D + {}^{2}D \rightarrow {}^{3}H + {}^{1}H$; $^{11}B + {}^{1}H \rightarrow {}^{8}Be + {}^{4}He$; $^{7}Li + {}^{1}H \rightarrow 2{}^{4}He$; $^{6}Li + {}^{2}H \rightarrow {}^{7}Li + {}^{1}H$. N. M. B.

Static interaction of charged particles. C. D. THOMAS (Physical Rev., 1938, [ii], **54**, 367—370).—Mathematical. N. M. B.

Lower limit for the theoretical energy of the normal state of helium. A. F. STEVENSON and M. F. CRAWFORD (Physical Rev., 1938, [ii], **54**, 375—379; cf. *ibid.*, **53**, 199).—A method of using a modification of Weinstein's lower limit for the energy is applied to the normal state of He, and leads to the lower limit −1·45508 Hylleraas units, with a probable increase to −1·45446, whereas the upper limit found by Hylleraas is −1·45187. The bearing of results on the probable location of the true eigenvalue and the general applicability of the method are discussed. N. M. B.

Theory of magnetically neutral solutions. A new possibility for the determination of magneton values. O. VON AUWERS (Z. Physik, 1938, **110**, 267—270).—The practical results of Salceanu (A., 1938, I, 238) are developed theoretically and it is shown that the method may be employed for the abs. determination of the magneton nos. of solutes. L. G. G.

Rutherford scattering with regard to radiation. W. BRAUNBEK and E. WEINMANN (Z. Physik, 1938, **110**, 360—372).—Mathematical. The formulæ of Mott, Sommerfeld, and Bethe for the action cross-section for nuclear scattering with radiation may be derived from the equation of Bloch and Nordsieck by developing the latter as a potential series of α (Sommerfeld fine structure const.). L. G. G.

Attempt at direct measurement of the magnetic moment of the ^{85}Rb nucleus. S. MILLMAN, I. I. RABI, and J. R. ZACHARIAS (Physical Rev., 1937, [ii], **51**, 379—380).—The val. obtained is ~1·8 nuclear magnetons. L. S. T.

Density of excited levels in heavy nuclei. S. GOUDSMIT (Physical Rev., 1937, [ii], **51**, 64). L. S. T.

Nuclear three-body problem. R. D. PRESENT and W. RARITA (Physical Rev., 1937, [ii], **51**, 382).—Theoretical. L. S. T.

Application of a new limitation in physical theory. H. T. FLINT (Nature, 1938, **142**, 535—536).—The application of a new limitation arising from quantum-relativity relations to an electron moving orbitally in an electrostatic field indicates that the *K*-level cannot exist in atoms with at. nos. >96. L. S. T.

Ultra-violet absorption spectra of some organic substances, examined in the solid state by means of a reflexion method. (MME.) T. GUILLMART (Bull. Soc. chim., 1938, [v], **5**, 1209—1218).—A detailed account of work already noted (A., 1938, I, 492). C. R. H.

Ultra-violet band spectra of HgCl, CdCl, and ZnCl. S. D. CORNELL (Physical Rev., 1938, [ii], **54**, 341—346).—The spectra excited in a high-frequency discharge are examined at high dispersion in the range 3200—2000 A. Vibrational analyses of several systems are given, and the electronic configurations involved in the systems are discussed. N. M. B.

Reactions of αβ-unsaturated aldehydes and ketones. II. Absorption spectra of typical compounds and their dihydro-derivatives. R. G. COOKE and A. K. MACBETH (J.C.S., 1938, 1408—1413).—The absorption spectra of phellandral, piperitone, carvone, and cryptone and of their H_2-derivatives have been determined in solutions of EtOH and C_6H_{14}. The saturated ketones show two max. of low intensity; the unsaturated ketones also show two max., one of high intensity in the region 2260—2355 A. (i), and the other of comparatively low intensity in the region 3120—3190 A. (ii). (i) is due to the ethenoid linking influenced by the CO group, whilst (ii) is due to the CO group influenced by the double linking. For phellandral, conjugation of the CHO group and the double linking gives a max. (ii) approx. 10 times that observed in the ketones examined. The spectra of cuminal and cuminic acid agree with recorded data for typical aromatic aldehydes and acids. W. R. A.

Absorption spectra of the halogen acids in the vacuum ultra-violet. W. C. PRICE (Proc. Roy. Soc., 1938, **A**, **167**, 216—227).—A system of new

absorption bands starting at 1762, 1491, and 1331 A., respectively, for HI, HBr, and HCl is described. In the case of HI a Rydberg series of bands was found. Mean ionisation potentials are determined.

G. D. P.

Ultra-violet band system of silicon monoselenide. R. F. BARROW (Nature, 1938, **142**, 434; cf. A., 1938, I, 341).—The ultra-violet band system of SiSe, obtained by means of a 2·5-amp. discharge in a SiO_2 tube containing Al selenide, contains ~30 bands, degraded towards the red, in the region 2914—3671 A., the $0 \rightarrow 0$ band being at 3089·3 A. and comparatively weak. L. S. T.

Ultra-violet band system of silicon monotelluride. R. F. BARROW (Nature, 1938, **142**, 536; cf. preceding abstract).—Details of the band system of SiTe, lying between 3307 and 3831 A. and with its $0 \rightarrow 0$ band at 3496·4 A., are recorded. The system is obtained by passing an a.c. discharge through powdered Al + Te in a SiO_2 tube.

L. S. T.

Absorption spectrum of the permanganate ion in different crystal lattices. J. TELTOW (Z. physikal. Chem., 1938, **B**, **40**, 397—430).—The visible absorption spectrum of MnO_4' ions has been examined at the temp. of liquid H_2 in cryst. solid solution with colourless salts, and in thin layers of pure $KMnO_4$. Crystal-embedded MnO_4' ions show two band systems, (I) and (II), in the green and red regions, I having an intensity $\gg$ that of II. The position, interval, and splitting-up of the bands are independent of the nature of the cations and of the lattice symmetry. The broadening of the lines of I, observed in many salts, is due to the disturbance of electron terms by the environment existing at the abs. zero. The nature of the disturbing influences is indicated. In thin mixed crystals, with the same cations, I shifts towards longer λλ with increasing space-filling of the lattice anions. II shows much more direction-dependence than I. In thin mixed crystals with $NaClO_4$, a wider red band system exists in two directions of vibration, and a band system in the violet which is observed with no other salt. Pure $KMnO_4$ is strongly sensitive to visible light, but no sensitivity has been observed with thin mixed crystals, except KIO_4 and $KHSO_4$ with small amounts of $KMnO_4$. W. R. A.

Study of the constitution of nitric acid from its absorption spectra. R. DALMON (Compt. rend., 1938, **207**, 473—475; cf. A., 1928, 590).—Vals. of the mol. extinction coeff. ϵ (λ 3180 A.) for aq. HNO_3 (0·8—24·6N.) at 1—2° are recorded. The decrease of ϵ with increasing concn. is linear at >10N., but becomes less rapid at higher concns.; ϵ reaches a min. at 23·6N. (97·2%) and then increases owing to the presence of N_2O_5. Application of Darmois' rule (A., 1934, 24) to the ϵ–λ curves confirms the existence of an equilibrium between NO_3' and some intermediate form at concns. >10N.; a second equilibrium, possibly involving the intermediate and homopolar forms, occurs at higher concns. A. J. E. W.

Non-association of photoconductivity with optical absorption in non-conducting crystals. C. ZENER (Physical Rev., 1937, [ii], **51**, 64).—Two new methods indicate that the photoconductivity of electrical insulators is not associated with the long-λ edge of the first absorption band. L. S. T.

Band spectra of BiF, BiCl, SbF, and SbCl. G. D. ROCHESTER (Physical Rev., 1937, [ii], **51**, 146).—Three new systems of bands, degraded towards shorter λλ, have been found in the spectrum of BiF at 3050—3250, 2650—2850, and 2250—2350 A. No new systems have been found in BiCl. The spectrum of SbF has groups of bands in the regions 3600—5200, 2600—2700, and 2200—2430 A. A new system in the region 4000—5500 A. has been found in the spectrum of SbCl. L. S. T.

Spectrum of cadmium fluoride, CdF. R. W. B. PEARSE and A. G. GAYDON (Proc. Physical Soc., 1938, **50**, 711—713).—The spectrum attributed by Asundi (cf. A., 1935, 562) to CdF has been identified with the known spectrum of CaF. Absorption bands incorrectly attributed to $CaBr_2$ and CaI_2 are due to $TlBr_2$, TlI_2, and BiI. N. M. B.

Spectroscopic studies on pinoresinol dimethyl ether, *epi*pinoresinol dimethyl ether, and *epi*-eudesmin. T. KAKU and K. ITTYODA (Keijo J. Med., 1938, **9**, 107—113).—Absorption spectra and curves of the three substances are given; those of the latter two are similar. F. JA.

Absorption spectra and fluorescence of heterocyclic compounds. O. V. FIALKOVSKAJA (J. Phys. Chem. Russ., 1938, **11**, 533—545).—Vapours of C_5H_5N, indole, furan, and thiophen have characteristic band absorption spectra. The spectrum of quinoline vapour is more diffuse. Different specimens of pyrrole give different spectra. Indole vapour fluoresces at room temp., and quinoline vapour above 80°. J. J. B.

Absorption spectra of azo-hydrocarbons and halochromy. T. UÉMURA and Y. INAMURA (Bull. Chem. Soc. Japan, 1938, **13**, 509—516).—Solutions of azo- and diazo-benzene, benzeneazo- and azo-diphenyl, benzeneazo-α-, αα′-azo-, αβ′-azo-, and ββ′-azo-naphthalene in C_6H_6 show an absorption band in the visible region and another in the ultra-violet. The position of the first varies little with the compound, whilst that of the ultra-violet band varies with the size of the azo-radical or the no. of double linkings.

E. S. H.

Absorption spectra of salicylaldehyde–ethylenedi-imine and related compounds. R. TSUCHIDA and T. TSUMAKI (Bull. Chem. Soc. Japan, 1938, **13**, 527—533).—Data for PhCHO–, *o*-OMe·C_6H_4·CHO–salicylaldehyde– (I), and *o*-hydroxyacetophenone–ethylenedi-imine (II) are recorded. In (I) and (II) a band in the near ultra-violet region is ascribed to a H linking between OH and N. The absorption spectrum of (I)–Co is discussed (cf. A., 1938, I, 432) and the steric configuration of the inner complex confirmed.

E. S. H.

Absorption spectra of metal complex salts of 2 : 2′-dipyridyl. II. K. YAMASAKI (Bull. Chem. Soc. Japan, 1938, **13**, 538—542; cf. A., 1937, I, 547).—Spectra of 2 : 2′-dipyridyl in hexane and in H_2O and of $[Mn(dip)_2]Cl_2$ (I), $[Co(dip)_2Cl_2]Cl$ (violet), and

$[Co(dip)_2CO_3]Cl$ in H_2O between 220 and 700 mμ. have been determined. The prep. of (I) is described. E. S. H.

Spectra of R_1–R_1 systems. Spectra of *l*-ascorbic, hydroxytetronic, reductic, and α-crotonic acid. (A) G. E. CARPÉNI. (B) H. MOHLER. (Helv. Chim. Acta, 1938, **21**, 1031—1036, 1036—1038).—(A) The conclusions of Mohler and Lohr (A., 1938, I, 342) are criticised.

(B) A reply. J. W. S.

Absorption spectrum of visual purple.—See A., 1938, III, 895.

Light absorption and absolute concentration of hydroxyl. L. AVRAMENKO and V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1937, **7**, 567—580).—Abs. absorption coeffs. for 2 lines in the OH band at $\lambda = 3064$ A. are calc. by theoretical formulæ from absorption measurements made at different temp. on the mixture $2/3\ H_2O + 1/3\ O_2$. The calc. heat of the reaction $H_2 + 2OH \rightarrow 2H_2O$ is 124 kg.-cal. and equilibrium consts. for the reaction are derived. The data are used to find the concn. of OH radicals in a dil. H_2 flame. J. A. K.

Optical absorption of fused germanium dioxide from 0·185 to 8·5 μ. R. W. SHAW (Physical Rev., 1937, [ii], **51**, 146).—Fused GeO_2 exhibits a uniform transmission from the near ultra-violet to 4·5 μ., except for a sharp absorption at 2·86 μ. The Raman spectrum, excited by the Hg line 3650 A., is a single band. The frequency interval between the band centre and the parent line corresponds with λ 2·88 μ. L. S. T.

Normal modes and frequencies of the sulphur molecule. S. BHAGAVANTAM and T. VENKATARAYUDU (Proc. Indian Acad. Sci., 1938, **8**, **A**, 101—114).—The model of the S_8 mol. is assumed to consist of a puckered octagon made up of two equal squares set at 45°. Expressions are derived for normal νν. Of the 11 normal modes, 4 are single and 7 doubly degenerate; their activity in Raman and infra-red spectra is discussed. W. R. A.

Raman spectrum and specific heat of sulphur. S. BHAGAVANTAM and T. VENKATARAYUDU (Proc. Indian Acad. Sci., 1938, **8**, **A**, 115—118).—The calc. vals. of the 11 normal νν (see preceding abstract) are compared with known infra-red and Raman data and show moderate agreement. Force consts. are derived. The vals. of the sp. heat, deduced from the spectroscopic data, are compared with recorded vals. W. R. A.

Normal frequencies of phosphorus (P_4). S. BHAGAVANTAM and T. VENKATARAYUDU (Proc. Indian Acad. Sci., 1938, **8**, **A**, 119—123).—Using the method employed for S (see preceding abstract) and assuming the P_4 has tetrahedral symmetry, T_d, the characteristics of its spectrum are deduced from the theory of groups. There should be 3 normal νν, all active in Raman effect but only one in infra-red. The νν comprise one single ν, one doubly and one triply degenerate. Polarisation features are discussed. Calc. vals. of νν agree with observed. Force consts. and the sp. heat at 9° have been evaluated. W. R. A.

Infra-red spectra. Absorption of the CH_2 group in the region of 3 μ. J. J. FOX and A. E. MARTIN (Proc. Roy. Soc., 1938, **A**, **167**, 257—281).—Seven substances containing CH_2 groups are investigated; in addition to the CH bands found near 3·27 μ. when an aromatic ring is present two or more bands near 3·4 μ. are attributable to the CH_2 groups. An analysis of the data for C_2H_4 leads to an explanation of the bands observed in more complicated mols. When the mol. contains only one CH_2 group two bands are observed which are identified as CH valency vibrations; if the no. of CH_2 groups is increased the no. of bands may increase beyond two. The mass to which the CH_2 group is attached has little effect on the position of the absorption bands, except in cases involving strain of the bonds connecting the CH_2 group to the rest of the mol. The substances examined are: $CH_2Ph{\cdot}OH$, CH_2Ph_2, $(CH_2Ph)_2$, and *cyclo*hexane, in which the CH_2 group is not subject to strain; fluorene, acenaphthene, and dioxan, where the CH_2 groups are attached to the mols. in a manner different from that in the other four compounds. G. D. P.

Infra-red absorption spectrum of methyl alcohol. (MISS) A. BORDEN and E. F. BARKER (J. Chem. Physics, 1938, **6**, 553—563).—The infra-red absorption spectrum from 2·5 to 26 μ. of gaseous MeOH has been examined with a grating spectrometer fitted with a KBr fore prism; it consists of 9 bands, six attributable to fundamental νν of the Me group and corresponding closely with known bands of Me halides, and three to the vibrations within the OH group. The mol. is only slightly asymmetrical. From the fine structure of the parallel band at 1034·18 $cm.^{-1}$ the two major moments of inertia are $35{\cdot}18$ and $33{\cdot}83 \times 10^{-40}$ g. $cm.^2$, whilst the third, not measurable directly, can be estimated as $\sim 6{\cdot}8 \times 10^{-40}$ g. $cm.^2$ A broad band of low ν (860—880 $cm.^{-1}$) indicates that the OH group does not undergo free rotation, at least in the ground state. There is some evidence of free rotation in states of high excitation. W. R. A.

Infra-red absorption spectra of $CH_3{\cdot}OD$ and $CH_2D{\cdot}OD$. E. F. BARKER and G. BOSSCHIETER (J. Chem. Physics, 1938, **6**, 563—568; cf. preceding abstract).—The spectra from 2·5 to 24 μ. have been measured for gaseous MeOD and $CH_2D{\cdot}OD$. Corresponding νν for the three analogues are compared and shifts are discussed. Comparison of gaseous and liquid samples shows large displacements of the bands arising from OH valency and deformation vibrations. The former cause shifts to longer λλ in the liquid, the latter to shorter λλ. W. R. A.

Rotation of water molecules in non-polar solvents. E. L. KINSEY and J. W. ELLIS (Physical Rev. 1937, [ii], **51**, 381).—Noteworthy features of the infra-red absorption bands of H_2O dissolved in CS_2 are discussed. L. S. T.

CD_4 fundamental bands. H. H. NIELSEN and A. H. NIELSEN (Physical Rev., 1937, [ii], **51**, 62—63).—The two active fundamental vibration–rotation bands ν_3 and ν_4 in the spectrum of CD_4 have been located and their rotational structure studied under

high resolving power. Their centres lie at 2259·0 and 996 cm.$^{-1}$, respectively. The moment of inertia can be computed from $\Sigma\Delta\nu = 3h/8\pi^2A$, where the val. found for A is $1{\cdot}091 \times 10^{-39}$ g.-cm.^{2}, or approx. twice that for CH_4. L. S. T.

Vibration spectra and molecular structure. IV. Infra-red absorption spectra of the double and single molecules of formic acid. L. G. BONNER and R. HOFSTADTER **V. Infra-red studies on light and heavy acetic acids.** R. C. HERMAN and R. HOFSTADTER. **VI. Infra-red absorption spectrum of heavy formic acid.** R. HOFSTADTER (J. Chem. Physics, 1938, 6, 531—534, 534—540, 540—543).—The infra-red absorption spectrum of HCO_2H vapour has been measured at various temp. up to 140° at which HCO_2H is monomeric. The different spectra are discussed from the viewpoint that H bonding causes dimerisation. A coincidence of C–H and O–H–O νν is suggested and to verify this "heavy" formic acid was prepared by passing D_2S through $(HCO_2)_2Pb$ at 100° and its spectrum taken. The results were not conclusive. Force consts. for C–O and C=O have been calc. and suggest single-double bond resonance for the C–O link but with a resonance energy < that predicted by Pauling and Sherman (A., 1934, 15).

V. The spectra of AcOD and AcOH have been measured from 1 to 15·5 μ. at 24° and 139°, *i.e.*, with, respectively, 9 and 97% of monomeric acid mols. present. For AcOD the band at 2299 cm.$^{-1}$ is very sensitive to temp. changes and is attributed to the D-bonded O–D–O vibration; in the protium compound the analogous band is at 3125 cm.$^{-1}$ The νν of "free" O–H and O–D, 3640 and 2653 cm.$^{-1}$, respectively, diminish and finally disappear as the temp. rises. The monomeride and dimeride spectra of both acids are quite different. For both, the C=O ν is 1737 cm.$^{-1}$ for the dimeride and 1770 cm.$^{-1}$ for the monomeride. Other νν also show appreciable shifts. The dependence of association on temp. has been investigated for AcOD and the heat of dissociation has been evaluated using the fundamental ν of the O–D–O vibration. A similar evaluation for the AcOH was impossible because the O–H–O ν falls in the region of the C–H valency vibrations. The heat of dissociation for AcOD is 15,900 g.-cal. per mole or 7950 g.-cal. per mole per bond. Assuming that the dimeride of AcOH is $CMe\begin{matrix}\swarrow O\cdots(D)H—O \\ \searrow O—H(D)\cdots O\end{matrix}\!\!>CMe$, and that the O–H(D)–O can be treated as asymmetric linear triat. mols. and that force consts. vary inversely with the cube of the equilibrium distance, the val. 1·07 A. for the shorter O–H(D) distance yields νν 1% different from 3125 and 2299 cm.$^{-1}$ The normal O–H distance is 0·97 A.

VI. The prep. of HCO_2D from D_2S and $(HCO_2)_2Pb$ yielded equal amounts of HCO_2H, HCO_2D, DCO_2H, and DCO_2D. By a simple exchange between HCO_2H and D_2O with subsequent dehydration with anhyd. $CuSO_4$ only HCO_2H and HCO_2D were obtained. Spectra of two samples with HCO_2D : HCO_2H ratios of 8 and 12·4 have been measured at approx. 25° and 145° from 1 to 15·5 μ. Assignments of νν are made. The calc. O–H(D) distance in the dimeric structure which gives best agreement with observed νν is 1·07 A. as for AcOH(D). W. R. A.

Infra-red study of several liquid crystals. R. TASCHEK and D. WILLIAMS (J. Chem. Physics, 1938, 6, 546—552).—The infra-red absorption spectra of three liquid crystals have been investigated at various temp. over the range 1—11 μ. in the isotropic and anisotropic states. Pronounced changes are exhibited at the m.p. and clearing points. The absorption is greatly influenced by the temp. and the location of max. are shifted. In the mesophase rapid changes in transmission occur which are qualitatively explained by Ornstein's theory. W. R. A.

Vibrational spectrum and thermodynamical properties of nickel carbonyl. B. L. CRAWFORD, jun., and P. C. CROSS (J. Chem. Physics, 1938, 6, 525—530).—The infra-red absorption spectra of liquid $Ni(CO)_4$ from 1 to 8 μ. and of $Ni(CO)_4$ vapour from 1 to 23 μ. have been measured. The results, which agree satisfactorily with those of Bailey and Gordon (A., 1938, I, 295), have been analysed in conjunction with the Raman data of Duncan and Murray (A., 1934, 1289) and indicate a tetrahedral, T_d, structure, although they do not completely exclude a square configuration (D_{4h}). Normal co-ordinates, selection rules, and spectroscopic characteristics for each structure have been derived by the method of group theory. Calc. νν of fundamentals, first overtones, and binary combination tones are tabulated and compared with observed infra-red data. The assignments which account for the Raman spectrum are given. Force consts. have been evaluated; that for C–O stretching is $15{\cdot}89 \times 10^5$ dynes per cm., which is intermediate between the vals. for C=O and C≡O. Interat. distances derived from force consts. agree with observed vals. By statistical mechanics the virtual entropy, the free energy function, and C_v have been determined at six temp. in the range 298—500° K. W. R. A.

Effect of temperature of uranin solutions on the fluorescence decay time. W. CRAM (Physical Rev., 1937, [ii], 51, 62).—The fluorescence decay times of eight different uranin (I) solutions have been measured over the range 0—70°. For low concns. (1×10^{-4} g. per c.c.) in H_2O or EtOH this time decreases 25% with a rise in temp. from 0° to 30°. An increase in concn. of (I) tends to weaken this effect, and at a concn. of 6×10^{-3} g. per c.c. it disappears. An increase in η also lowers the temp. effect. Glycerol solutions show no temp. effect. L. S. T.

Selective extinction of continuous fluorescence spectra. N. PRILESHAEVA (Acta Physicochim. U.R.S.S., 1937, 7, 149—162).—Max. extinction of the continuous fluorescence of PhMe, PhEt, PhOH, and NH_2Ph by N_2 and CO occurs at the frequencies corresponding with the vibration levels of the latter gases. With H_2 max. extinction occurs at 2800 A., corresponding with the dissociation of H_2 into atoms. With CO_2 and H_2O two max. occur, probably corresponding with the energy of activation of the unimol. decomp. of these mols. No selective extinction was observed with O_2 and NH_3. Selective extinction is

attributed to a kind of Raman effect through collisions of the second kind. J. W. S.

Sensitised fluorescence of aniline and benzene vapours. N. PRILESHAEVA and A. KLIMOVA (Acta Physicochim. U.R.S.S., 1937, **7**, 163—170).—Sensitised fluorescence produced by processes of the type $A + B^* \rightarrow A^* + B$ is attributed to intersection of the potential curves of the two states of the system, and it is concluded that under suitable conditions the reverse reaction should occur, giving anti-Stokes sensitised fluorescence. This is confirmed by observation for the systems NH_2Ph–indigotin and NH_2Ph–C_6H_6. J. W. S.

Resolution and interpretation of the luminescent spectra of some solids at low temperatures. J. EWLES (Proc. Roy. Soc., 1938, **A**, **167**, 34—52).—Ultra-violet bands excited by cathode-ray bombardment of CaO and SrO show frequency differences close to the vibrational frequencies of the crystal lattices. The optically excited spectra of pure CaO and of CaO activated with Bi are similar to those excited by cathode rays. The bands in the visible region are not resolved and are independent of the nature of added impurities. It is suggested that the luminescent spectra of the alkaline-earth oxides and sulphides are to be regarded as electron vibration bands associated with the crystal lattice, and a possible mechanism for short-duration phosphorescence is discussed. The compounds examined are CaO, BaO, BaS, $BaCO_3$, ZnO, ZnS, MgO, and Zn silicate, activated with different impurities. G. D. P.

Adsorption in preparative phosphorescence chemistry. Zinc sulphide system. E. TIEDE and W. SCHIKORE (Z. Elektrochem., 1938, **44**, 586).—The influence of traces of Cu and Fe on the phosphorescence of ZnS is described. C. R. H.

Hexaco-ordination in telluric acid, and in molybdates and tungstates in solution. J. GUPTA (Indian J. Physics, 1938, **12**, 223—232).—The Raman spectra of telluric acid and several molybdates and tungstates have been re-examined in the cryst. state and in aq. solutions of definite p_H. Further theoretical and experimental evidence is produced in support of the author's previous conclusion (A., 1937, I, 598) that normal MoO_4^{--} and WO_4^{--} ions exist like H_2TeO_4 as dihydrated octahedral units. The extra lines recorded by the other workers, *e.g.*, Venkateswaran (A., 1938, I, 228), are not due to the normal ions. T. H. G.

Raman effect. LXXXVII. Esters of arsenious, phosphorous, and orthocarbonic acids. A. W. REITZ and R. SABATHY (Z. physikal. Chem., 1938, **B**, **41**, 151—162).—Raman measurements of the Me and Et esters and polarisation measurements of HCO_2Me and anisole are recorded. The data are discussed in connexion with the CH frequency of the OMe group in various types of compounds. C. R. H.

Raman spectra of solutions of mercuric cyanide in ammonia and pyridine. M. V. VOLKENSTEIN (Acta Physicochim. U.R.S.S., 1937, **7**, 315—316).—In the Raman spectra of solutions of $Hg(CN)_2$ in liquid NH_3 and in C_5H_5N the NC–Hg–CN and CN frequencies are greatly reduced. This is attributed to a decrease in the strength of the linkages through complex formation. J. W. S.

Raman effect in binary mixtures with liquid sulphur dioxide. M. V. VOLKENSTEIN (Acta Physicochim. U.R.S.S., 1937, **7**, 313—314).—Binary mixtures of CCl_4 and $CHCl_3$ with liquid SO_2 show only additivity of Raman spectra. Mixtures of SO_2 (4 mol.) and BCl_3 (1 mol.) show additivity initially, but gradually develop the $\nu\nu$ of $SOCl_2$. In mixtures of SO_2 (3 mol.) and Me_2O (2 mol.) the 920 cm.$^{-1}$ frequency of Me–O–Me is diminished, whilst the three $\nu\nu$ of Me are raised. These changes are attributed to orientation effects of the dipoles. J. W. S.

Spectra of light scattered by the crystals of acetic acid, bromoform, and *cyclo*hexane. A. I. SIDOROVA (Acta Physicochim. U.R.S.S., 1937, **7**, 193—200).—The Raman spectrum of solid $CHBr_3$ contains a broad line corresponding with ν 32—52 cm.$^{-1}$, whilst that of solid AcOH contains $\nu\nu$ 49 and 119 cm.$^{-1}$ These $\nu\nu$ correspond with the "wings" observed in the Raman spectra of the liquids. There are no low-ν lines in the Raman spectrum of cryst. C_6H_{12} and no wings observable in that of the liquid. The Raman spectrum of AcOH contains a series of $\nu\nu$ in the range 900—1750 cm.$^{-1}$ which are not observed for the liquid. J. W. S.

Raman spectra of acrylic acid and of methyl and ethyl methacrylates at various degrees of polymerisation. D. MONNIER, B. SUSZ, and E. BRINER (Helv. Chim. Acta, 1938, **21**, 1349—1355; cf. A., 1938, I, 61).—$\nu\nu$ and intensities are recorded for $CH_2{:}CH{\cdot}CO_2H$, monomeric and polymerised $CH_2{:}CH{\cdot}CO_2Me$, and monomeric, polymerised, and partly polymerised $CH_2{:}CH{\cdot}CO_2Et$. The intensity of the C:C frequency decreases and that of the CH_3 frequency increases progressively with increasing degree of polymerisation. This supports the view that polymerisation is due to breaking of C:C linkings and chain formation. J. W. S.

Raman spectrum of diphenyl. S. K. MUKERJI and S. A. AZIZ (Indian J. Physics, 1938, **12**, 271—282).—The Raman spectrum of molten Ph_2 has been studied by carefully cutting out the continuous background with suitable filters, thereby revealing certain new faint lines. The ground frequencies of C_6H_6 are also observed with Ph_2; the characteristic frequency due to the internuclear C–C bond is 1283 cm.$^{-1}$ T. H. G.

Raman spectra of compounds with three benzene rings [*o*- and *m*-diphenylbenzene]. S. K. MUKERJI (Nature, 1938, **142**, 477).—33 new lines for *o*- and 27 for *m*-$C_6H_4Ph_2$ in the molten state are recorded. L. S. T.

Raman spectra of some organic dicyclic compounds. B. D. SAKSENA (Proc. Indian Acad. Sci., 1938, **8**, **A**, 73—100).—Raman displacements and depolarisation factors have been measured for $C_{10}H_8$, deca- and tetra-hydronaphthalene (I), indene, and *trans*-β-decalone in the liquid states and, except for the last compound, compared with existing infrared and Raman data. By means of the theory of groups the spectroscopic characteristics of possible

mol. models have been determined and examined in the light of the experimental vals. $C_{10}H_8$ has a structure possessing a centre of symmetry; (I) is puckered. The Raman spectrum of solid *trans*-decahydro-β-naphthol has also been measured. W. R. A.

Raman effect and problems of constitution. XII. Condensed dicyclic hydrocarbons resembling naphthalene. K. W. F. KOHLRAUSCH and R. SEKA (Ber., 1938, **71**, [*B*], 1551—1562).—The Raman spectra of *o*-C_6H_4MeEt, indane (I), indene (II), 1 : 2 : 3 : 4-tetrahydronaphthalene (III), Δ^1- (IV) and Δ^2-dihydronaphthalene, and *o*-C_6H_4Me·CH:CH·CO_2Et are recorded. Transition from mono- to *o*-di-derivatives of C_6H_6 causes typical spectral changes. It is possible therefore to speak of an "*ortho* spectrum" of C_6H_6 derivatives and the relationship of the lines to the vibration forms has been partly determined. According to their spectra (I) and (III) in which the side-chains are closed to a saturated ring are regarded as *ortho*-derivatives. They differ little from one another in the main lines although (I) is of similar symmetry to *o*-xylene whereas (III) is less symmetrical probably due to a non-planar character of the mol. Introduction of a double linking into the closed side-chain makes the relationships less certain; it appears, however, that (II) and (IV) like (I) and (III) have mols. of "benzenoid type." The transition to $C_{10}H_8$ is accompanied by such increase of symmetry that nothing can be achieved by qual. comparison. With such closely related, similar and almost compensated systems as are presented by the two halves of the $C_{10}H_8$ chain it is unwise to select certain lines and to assign them to oscillations of definite portions of this chain. The difficulties of a strict analysis of the spectrum are discussed. H. W.

Raman effect and problems of constitution. XIII. Condensed heterodicyclic systems resembling naphthalene. K. W. F. KOHLRAUSCH and R. SEKA (Ber., 1938, **71**, [*B*], 1563—1570).—The spectra of coumaran, coumarone, benzoxazole, anthranil, indole, 2-methylindole, indazole, benztriazole, benzthiazole, and thionaphthen are recorded and discussed. Qualitatively they show nearly all the phenomena characteristic of *o*-substituted benzenes; in this respect the spectra are so similar amongst themselves that a common factor in their structure must be assumed. On the other hand the dicyclic compounds are not *o*-derivatives so that deviations occur. In these deviations the spectra of the heterocyclic compounds are individual and distinct from one another so that certain finer structural differentiations exist within a common structural frame. These differences are ascribed to changes in the mechanism of union since the spectra of chains (C_3H_8–Me_2O–$NHMe_2$; piperazine–piperidine–*cyclo*hexane–pentamethylene oxide–dioxan–morpholine; $C_{10}H_8$–quinoline–*iso*quinoline; C_6H_6–C_5H_5N) are qualitatively of a precisely similar type. On the other hand these spectral differences occur mainly in the frequency region 1200—1600 cm.$^{-1}$ where among unsaturated compounds are found the high chain frequencies essentially dependent on the system of double linkings. H. W.

Raman spectrum and fluorescence of dioxan. H. W. HUNTER (J. Chem. Physics, 1938, **6**, 544—545).—The Raman spectrum of dioxan, excited by the 3126 and 3132 A. Hg lines, consists of 11 νν. When dioxan in a quartz tube is illuminated by a quartz Hg arc a strong continuous band appears in the visible with max. at 5800 and 4500 A. This fluorescence is not exhibited by dioxan in a glass tube and must therefore be caused by λλ <2900 A. At 12° the fluorescence extends from 3400 A. throughout the visible; its intensity diminishes rapidly as temp. increases. Irradiation for three days gave the same fluorescence as exhibited by a fresh sample. Dioxan does not lose its transparency on continued exposure to ultra-violet light. W. R. A.

Raman effect. LXXXVI. Ethyl derivatives. J. WAGNER (Z. physikal. Chem., 1938, **B**, **40**, 439—449).—Et derivatives are considered as valency force systems constituting an asymmetrical three-mass model, Me·CH_2·X. Raman data for 8 compounds are analysed. The theory holds for the chain νν only when the at. mass of X is <36. Force consts. are < and interat. distances are > for corresponding Me compounds. W. R. A.

Intensity of the [Raman] lines of the benzene ring in monosubstituted derivatives. E. VITALE (Nuovo Cim., 1936, **13**, 284—289; Chem. Zentr., 1936, ii, 3899).—The Raman lines of C_6H_6, NH_2Ph, PhOH, $PhNO_2$, and PhMe are similarly placed but the following differences in intensity (variation with the electric moment) are noted : ν = 607 cm.$^{-1}$, PhOH >, PhMe and NH_2Ph <, C_6H_6; 1170 cm.$^{-1}$, PhMe and $PhNO_2$ >, PhOH and NH_2Ph <, C_6H_6; 1585 cm.$^{-1}$, all > C_6H_6; 3005 cm.$^{-1}$, PhOH and $PhNO_2$ >, PhMe and NH_2Ph <, C_6H_6. A. H. C.

Contact p.d. between different faces of silver single crystals. H. E. FARNSWORTH (Physical Rev., 1937, [ii], **51**, 378).—After outgassing at < visible red heat for 160 hr. the (111) face of one Ag single crystal is positive by approx. 0·4 v. with respect to the (100) face of another. The true val. is probably > 0·4 v. L. S. T.

Electronic conduction due to 4*f* electrons in some tervalent rare-earth compounds. K. GHOSH and B. GHOSH (Indian J. Physics, 1938, **12**, 259—270).—Using fine powders compressed in the shape of solid rings and placed between coaxial cylindrical electrodes, the conductivities of the fluorides of La, Ce, Pr, and Nd have been determined. By deducting the conductivity of LaF_3 from each the contribution due to the extra 4*f* electrons in the other metals can be found. Using a formula similar to that of Wilson, it is found that the vals. of the energy difference between the top of the completely filled band and the bottom of the completely empty band agree roughly with results from magnetic and spectroscopic data. T. H. G.

Contact potentials. B. GYSAE and S. WAGENER (Z. Physik, 1938, **110**, 145—163).—The contact p.d. between two bodies is resolved into its component parts which are defined by equations. The true contact potential is defined and a method described for its measurement in the case of Ta and W. H. C. G.

Dielectric properties of some organic substances. G. R. PARANJPE and D. J. DAVAR (Indian J. Physics, 1938, **12**, 283—288).—*d*, n_D, and dielectric const. (at 7500 kc.) have been determined at 30° for oleic acid, linoleic acid, triolein, triricinolein, and tristearin in C_6H_6 solution. The polarisations and electric moments have been calc. from the Debye equation, using the method of least squares. The electric moments, which have been explained in terms of the chemical constitution and structure of the substances, are 1·009, 1·208, 3·158, 4·117, and 2·844 D., respectively. T. H. G.

Variation with field strength of the dielectric constant of *p*-azoxyanisole. W. MAIER (Ann. Physik, 1938, [v], **33**, 210—225).—A method for the measurement of dielectric consts. at const. frequency and with varying amplitude of the measuring field is described. ϵ of *p*-azoxyanisole has been measured at 651,000 Hz, temp. from 119° to 145°, and field strengths from 37 to 330 V. per cm. ϵ of the anisotropic phase is 5·4 at 290 V. per cm. The dipole moment is 2·3 D. O. D. S.

Viscosity dispersion of the dielectric constants of organic liquids. E. PLÖTZE (Ann. Physik, 1938, [v], **33**, 226—242; cf. A., 1938, I, 436). O. D. S.

Dielectric constants and dipole moments of dimethyl citraconate and dimethyl mesaconate and their ozonides; heat of ozonisation of these esters. E. BRINER, D. FRANK, and E. PERROTTET (Helv. Chim. Acta, 1938, **21**, 1312—1317).—The following vals. of ϵ have been obtained at 20°: Me_2 citraconate (I) 8·71, Me_2 mesaconate (II) 7·15, Me_2 citraconate ozonide (III) 10·52, Me_2 mesaconate ozonide (IV) 8·77. Measurements on dil. solutions in C_6H_6 yield the following vals. of μ (in D.): (I) 2·68, (II) 2·06, (III) 2·8, (IV) 2·5. From the heats of combustion of the esters and of their ozonides the heats of ozonisation are (I) 110·8 and (II) 131·3, kg.-cal. per mol., respectively. The differences in properties for the *cis*- and *trans*-isomerides are in accord with previous results (A., 1937, I, 65). J. W. S.

Rotation of dipoles in solution. P. GIRARD and P. ABADIE (Physikal. Z., 1938, **39**, 691—692).—The dispersion and absorption curves for PrOH in C_6H_{14} have been determined up to 40 vol.-% PrOH. Comparison of these curves with those of pure PrOH shows the effect of the non-polar mols. of the solvent on the rotation of the PrOH dipoles in an alternating field. The effect is similar to the retarding action of a considerable increase in viscosity. The dispersion curve is displaced towards longer λ and there is also a difference in the slope of the curve. The retardation of the PrOH dipoles varies with the nature of the solvent. A. J. M.

Chemical war materials. X. Theoretical bases of the interpretation of molecular structure from dipole moments. H. MOHLER and C. T. ZAHN. XI. Dipole moments and molecular structure. Interpretation of the experimental data. C. T. ZAHN and H. MOHLER (Helv. Chim. Acta, 1938, **21**, 1276—1283, 1284—1296).—X. Factors inhibiting free rotation in simple mols. are classified and their effects on the dipole moments of these mols. are discussed.

XI. From the dipole moments of various eye, nose, and throat irritants and of lung and skin poisons (A., 1938, I, 388) the probable spatial arrangements of these mols. are deduced and are correlated with their physical and chemical properties. J. W. S.

Dielectric polarisation. XXIII. Dipole moments of some aliphatic and aromatic aldehydes and of anthrone. D. I. COOMBER and J. R. PARTINGTON (J.C.S., 1938, 1444—1452).—The dipole moments of several aldehydes in C_6H_6 solution have been determined. MeCHO has a val. of 2·49 D. and EtCHO, 2·54 D.; the moments of the higher members attain a practically const. val. (2·57). These results are discussed with reference to the series effect. The moments of PhCHO and its derivatives indicate an angle of 55° between the axis of the ring and the C=O direction. The effect of interaction moments in *p*-substituted compounds is deduced from a comparison with the corresponding acid chlorides and the results obtained indicate an angle of 125° between the axes of the rings in $COPh_2$. The CHO groups in p-$C_6H_4(CHO)_2$ exhibit completely free rotation. W. R. A.

Electric polarisations of some metallic acetylacetonates. A. E. FINN, G. C. HAMPSON, and L. E. SUTTON (J.C.S., 1938, 1254—1263).—Dipole measurements have been made on Be acetylacetonate in a variety of solvents, and between 298° and 415° K. in decalin, and on several metallic acetylacetonates in C_6H_6 solution. The data obtained in non-polar solvents show a large difference (approx. 45% $_E P_2$) between the mol. total polarisation P_2 and the mol. electron polarisation $_E P_2$ of the solute, which has second-order dependence on the solvent, and falls into one of three groups of rough ratio 2 : 3 : 4 as the compound contains 2, 3, or 4 chelate groups. The results may be due to (i) a transitory electric moment arising from slow bending within the mol. caused by thermal bombardment (cf. Hampson, A., 1934, 1157), or (ii) to atom polarisation, in which the field induces considerable moments by causing inter-nuclear movements. (i) is not probable, as calculations show that the frequency of bending would be too high for the mol. to orient while bent. W. R. A.

Electric moments of *p*-benzoquinone and related compounds. D. L. HAMMICK, G. C. HAMPSON, and G. I. JENKINS (J.C.S., 1938, 1263—1268; cf. preceding abstract).—*p*-Benzoquinone (I), its symmetrical Me_2 and Cl_2-derivatives, and 2 : 2 : 4 : 4-tetramethyl*cyclo*butane-1 : 3-dione, with geometrically symmetrical mols. the electric moments of which should be zero, are definitely polar, with an approx. const. difference between their total and electron polarisations. A mechanical model of the structure of (I) shows that polarisation by bending is possible, but cannot be the primary cause. This is confirmed by calculation of the frequency of bending, which does not agree with the infra-red absorption ν. The polarisation discrepancies are therfore high atom polarisations or solvent effects. W. R. A.

Electric polarisations of the vapours of some substances having anomalous dipole moments,

and their bearing on the theory of atom polarisation. I. E. COOP and L. E. SUTTON (J.C.S., 1938, 1269—1286; cf. preceding abstract).—The electric polarisations of various acetylacetonates, symmetrical diketones, symmetrical $(NO_2)_2$- and $(CN)_2$-compounds, and tetrahalides in the vapour state have been measured over various ranges of temp. The polarisations are temp.-independent, and comparison with results obtained in solution (*loc. cit.*) shows that the anomalous moments are not due to solvent effects. The compounds studied are non-polar in their unperturbed configurations, and can become polar only as a result of bending or twisting. The observed facts are therefore due either to slow thermal bending or to atom polarisation, P_A. Calculation of the vibration frequencies, however, eliminates the former. Extending the theory of P_A, a relation is obtained between P_A, force const. of bending, and bond moment for a mol., which has been tested quantitatively with success for a no. of compounds; the series of $HgPh_2$ compounds proves an exception. The polarisations of the diketones studied are explained by the hypothesis that each C=O bond bends relatively to the rest of the mol. and perpendicular to the plane of the double bond. W. R. A.

Electrical moments of dioximes. M. MILONE (Congr. int. Quim. pura apl., 1934, **9**, II, 191—196, 196—198; Chem. Zentr., 1936, ii, 3659).—The moment of symmetrical αβ-dioximes is > that of the asymmetrical next higher homologues indicating the *amphi*-configuration. Glyoxime and its Me, Me_2, Me Et, Me Pr, and Me *n*-octyl derivatives were examined. β- (*amphi*-)forms of higher moment of α- and β-phenyl, -tolyl, -phenylmethyl, and α-, β-, and γ-diphenyl-glyoximes are also described. A. H. C.

Optical activity of serum-proteins.—See A., 1938, III, 872.

Theory of absorption in ionised gases. I. Opacity in stellar material. II. Optical properties of liquid metals. B. MAJUMDAR (Indian J. Physics, 1938, **12**, 233—248).—Mathematical. A quantum theory has been deduced in which the energy taken up from the electrical field of the incident radiation by the electrons is transformed by collision with the ions into random motion of the electrons and ions. The theory is then used to calculate the opacity coeffs. of stellar material; it is in fair agreement with observed results when applied to the optical properties of liquid metals. T. H. G.

Constitution of potassium thiocyanate. Refractometric investigation. G. SPACU and E. POPPER (Z. physikal. Chem., 1938, **182**, 389—392).—The measured val. of the mol. refraction of KCNS is 19·849, in accord with the val. calc. for K·S·C:N (20·817) rather than with that calc. for K·N:C:S (22·146). J. W. S.

Double refraction of anisotropic liquids. W. KAST (Ann. Physik, 1938, [v], **33**, 185—191; cf. A., 1934, 478).—Theoretical. The anisotropic melt and the crystal of *p*-azoxyanisole have equal mol. refractions and show the same dispersion of the double refraction between 589 and 546 mμ. The degree of orientation in the melt between 119° and 133° is calc. O. D. S.

Dispersion theory. C. SCHAEFER (Ann. Physik, 1938, [v], **33**, 243—248).—Classical theory leads to a dispersion formula of the same type as that derived from wave mechanics. O. D. S.

Determination of molecular dispersion with the Abbe refractometer. H. WALDMANN (Helv. Chim. Acta, 1938, **21**, 1053—1065).—For normally dispersing org. and inorg. compounds the dispersion curve shows a definite regularity within the λ region between the H_α and H_β lines. From the relationship $(n_D - n_C)/(n_F - n_C) = 0{\cdot}286$ it is possible to deduce the vals. of n_F and n_C from measurements of n_D made with an Abbe refractometer and the appropriate mean dispersion $(n_F - n_C)$. It is therefore possible to calculate the mol. dispersion from measurements made on an Abbe refractometer. J. W. S.

Magnetic rotatory power of hydrofluoric acid. R. DE MALLEMANN and F. SUHNER (Compt. rend., 1938, **207**, 494—495).—The mol. rotatory power of aq. HF = $1{\cdot}30 \times 10^{-5}$ (λ 578 mμ.), showing that the rotation of F' is very small and of the same order as that of $H^{\cdot}$. The rotation of fluorides is consequently only slightly > that of the cation involved. The at. rotation of F is probably negative. A. J. E. W.

Magnetic rotatory power of imperfect complexes. F. GALLAIS (J. Chim. phys., 1938, **35**, 249—261; cf. A., 1938, I, 498).—Anomalies observed in the Faraday effect are interpreted in relation to the constitution of the complexes. The formation of co-ordination linkings in a mol. is not always accompanied by exaltation of the Faraday effect. Applications to the study of dissolved complexes and the prep. of solutions with a high Verdet const. are discussed. E. S. H.

Graphical representation of the energy states of a diatomic molecule on the basis of band spectroscopic data. R. SCHMID and L. GERÖ (Ann. Physik, 1938, [v], **33**, 70—88). O. D. S.

Indeterminacy and electron spin. R. T. COX and F. E. MYERS (Nature, 1938, **142**, 394).—Quantum indeterminacy would prevent observation of the difference in potential energy between two free electrons in magnetised Fe with magnetic axes parallel and anti-parallel, respectively, to the direction of magnetisation. L. S. T.

Deformation of molecules in a condensed phase and the "hydrogen bond." E. BAUER and M. MAGAT (J. Phys. Radium, 1938, [vii], **9**, 319—330).—A theory developed from the electrostatic action of neighbouring mols. is described; it explains the characteristics of the OH bond in different substances. The postulated existence of a homopolar "H bond" is considered unnecessary. W. R. A.

Significance of subsidiary valency forces for the elastic properties of high-molecular substances. W. KUHN (Angew. Chem., 1938, **51**, 640—647).—In the consideration of the elastic properties of high-mol. substances the rapidly changing configuration of the free mol. taking place without the breaking of principal valencies is important. The

changes of configuration of a thread mol. suspended in a solution are considered. The elastic properties of rubber and the effect of temp. on them are discussed, and the significance of subsidiary valency forces for the occurrence or non-occurrence of this type of elasticity is considered. The crystallisation on stretching of many high-mol. substances which have rubber-like elasticity is also considered, as well as the elastic after-effect. A. J. M.

Structure of acids derived from metal halides. A. GLAZUNOV (Chem. Listy, 1938, **32**, 289—292).—A discussion. R. T.

Structure of substances with enediol-α-ketonic function. G. E. CARPÉNI (J. Chim. phys., 1938, **35**, 233—248).—Mol. structure and the influence of cyclisation and substitution on total acid function are discussed in the light of published data on dissociation consts. E. S. H.

Stability of formic acid dimeride.—See A., 1938, II, 390.

Nucleus formation under the influence of electrical charges. G. TOHMFOR and M. VOLMER (Ann. Physik, 1938, [v], **33**, 109—131).—Theoretical. The formation of drops in the Wilson chamber and at the electrodes of an electrolytic cell is discussed. O. D. S.

Reciprocal influence of carbon atom linkages. T. FÖRSTER (Z. Elektrochem., 1938, **44**, 620).—A brief commentary on the application of Raman spectra to the analysis of mol. structure. C. R. H.

Duration of energy exchange between gas molecules and solid surfaces. W. HUNSMANN (Z. Elektrochem., 1938, **44**, 606—610).—The derivation of the relation $\alpha = \tau/(\tau + \beta)$, where α, τ, and β are respectively the accommodation coeff., the adsorption time, and the induction period, permits the calculation of an abs. val. for β from known vals. of α and τ. Data have been obtained for the adsorption on SiO_2 and NiO of C_2H_6, C_2H_4, N_2O, and SF_6. The vals. of α for SiO_2 and NiO are of the same order, but the val. of β for NiO is 50—100 times the val. for SiO_2. The data gree with Herzfeld's theory that the exchange of energy of vibration occurs relatively quickly only if there is resonance between mol. and lattice frequencies. SiO_2, with a higher frequency than NiO, is more likely to have such resonance. C. R. H.

Frequency of vibration of molecules in liquids and its relation to viscosity. D. B. MACLEOD (Proc. Physical Soc., 1938, **50**, 788—800).—An expression is found for the variation with temp. of the average frequency of vibration of a mol. in a liquid. The abs. frequency is calc. approx. and is used in Andrade's expression for η of a liquid at the m.p. to obtain an expression for the variation of η with temp. Results as given by this expression and by a relation found by Andrade are tabulated and compared for liquid Ga, K, Na, Sn, Br, and Hg at various temp. Data for sp. vol., free space, abs. η, and temp. variation of η are tabulated and compared with experiment, and the calc. internal pressures of Sn, Ga, Hg, Na, K, and Br are given. N. M. B.

Molecular models of dielectrics. L. HARTSHORN (Proc. Physical Soc., 1938, **50**, 852—855).—Structural features of complex org. compounds are illustrated by models assembled cheaply and simply from coloured wooden balls of various sizes connected by pegs fitting into holes. White balls in hexagon formation represent aromatic C atoms forming C_6H_6 rings, black balls link the hexagons and represent CH_2 groups, and spotted balls represent OH groups. Soluble resin (Novolak), heat-hardened resin (Bakelite), polystyrene, and chlorinated rubber are shown. N. M. B.

New thermodynamic calculation of the degree of dissociation. K. H. RIEWE (Z. Physik, 1938, **110**, 393—394).—Theoretical. L. G. G.

Physical significance of crystallographic ionic radii. H. JENSEN, G. MEYER-GOSSLER, and H. ROHDE (Z. Physik, 1938, **110**, 277—290).—Ionic radii in different types of lattice are discussed from the quantum-mechanical viewpoint. H. C. G.

Quantum theory of the polarisibility of atoms and ions in inhomogeneous electric fields. H. HELLMANN and S. J. PSCHEJETZKI (Acta Physicochim. U.R.S.S., 1937, **7**, 621—645).—A crit. discussion of the present theoretical methods for extrapolating the ordinary polarisibility of atoms with completely filled outer shells in order to obtain the effective polarisibility in the inhomogeneous field of a point charge. A new approximation method is developed and applied in detail to HCl and H_2O. J. A. K.

Probability of annihilation of positrons without emission of radiation. H. S. W. MASSEY and E. H. S. BURHOP (Proc. Roy. Soc., 1938, **A**, **167**, 53—61).—The process considered is a collision of a positron with an at. electron with mutual annihilation, but the energy liberated, instead of being radiated, is used to eject another electron from the atom. The calculation is carried out for a *K*-electron of a Pb atom, and it is concluded that about one positron in 10,000 would be annihilated by a radiationless process. It is considered that the process should be observable in a cloud chamber. G. D. P.

Calculation of intermolecular forces and energies. M. L. HUGGINS (Physical Rev., 1937, [ii], **51**, 379).—The resultant force between two mols. is considered as the sum of interpenetration repulsions, attractions of the London " dispersion " type, forces between dipoles, and valency or exchange forces. L. S. T.

Critique of the quantum theory of metallic conduction. E. WEBER (Physical Rev., 1937, [ii], **51**, 378).—Shortcomings of the quantum theory are pointed out. A new theory of electric conduction is proposed. L. S. T.

Faraday effect in the *X*-ray region. H. T. CLARK and K. LARK-HOROVITZ (Physical Rev., 1937, [ii], **51**, 61). L. S. T.

***X*-Ray analysis of crystal structure.** G. SELÉNYI (Tech. Kurir, 1938, **9**, 65—66).—A review. E. P.

Determination of crystal structure from *X*-ray data. M. AVRAMI (Physical Rev., 1938, [ii],

54, 300—303).—Mathematical. Structure-factor formulæ are replaced by an approximating system leading to equations from which the co-ordinates of at. positions or interat. distances are found. Results are illustrated with reference to the KH_2PO_4 crystal. N. M. B.

X-Ray diffraction of substances under high pressures. R. B. JACOBS (Physical Rev., 1938, [ii], 54, 325—331).—An apparatus described for *X*-ray diffraction work on specimens under pressures up to 5000 atm. uses He as compressive medium and contains the complete camera and specimen within the compression chamber, the *X*-rays being incident through a Be window in the chamber wall. Results are given for the transition AgI(II)–AgI(III). The crystal structure of AgI(II) is cubic NaCl type. The vol. change in transition is > when measured by over-all methods, and an explanation is given. Some results on Cd and RbCl are reported. N. M. B.

Effect of a direct electric field on Laue diffraction photograms. A. NĚMEJCOVÁ and J. BROŽ (Physical Rev., 1938, [ii], 54, 379—384).—Investigations on Laue photograms of SiO_2, mica, and gypsum crystals show that the intensity of the Laue reflexions is increased and the central spot is made narrower. If the field is applied to the crystals through Al coatings, deposited by evaporation on both surfaces of the crystals, the narrowing of the central spot increases only up to a certain field intensity, and a time influence is observed, *i.e.*, if the field is applied for a longer time or if sufficiently aged Al coatings are used the difference in the central spot with and without the field disappeared. The narrowing is caused by alternations provoked in the crystal lattice by the field. Explanations of results are discussed. N. M. B.

Scattering of *X*-rays at beryllium at small angles. K. ALEXOPOULOS and S. PERISTERAKIS (Physikal. Z., 1938, 39, 688—690).—The scattering of *X*-rays at Be in the range $(\sin\theta/2)/\lambda = 0{\cdot}013$—$0{\cdot}054$ has been investigated. The scattering curve agrees with that of Scharwächter (A., 1937, I, 224), but shows deviations from the theoretical curve in the expected direction at very small angles. A. J. M.

Simplified derivation of the Laue particle size equation. B. E. WARREN (Z. Krist., 1938, 99, 448—452; cf. Laue, *ibid.*, 1926, 64, 115).—Mathematical. The results agree in essentials with other forms (Scherrer, Bragg). I. McA.

Test of the cellular method of obtaining lattice functions. W. SHOCKLEY (Physical Rev., 1937, [ii], 51, 379). L. S. T.

Crystallisation of polymorphous substances from the vapour phase. II. S. E. MADIGAN and K. LARK-HOROVITZ (Physical Rev., 1937, [ii], 51, 61; cf. A., 1935, 151).—An *X*-ray method for the quant. determination of the constitution of polymorphous mixtures has been applied to the deposition of ZnS from the vapour phase. The amount deposited in the cubic or hexagonal form depends on conditions of temp. and pressure. At a high rate of evaporation and in presence of inert gases the unstable form is always deposited. At a slow rate in a vac. most of the nuclei seem to form at the gas-solid interface. Single crystals of Zn blende split in a vac. immediately before deposition show that crystal growth starts from different centres distributed at random over the surface. L. S. T.

Structure of molten salts. E. P. MILLER and K. LARK-HOROVITZ (Physical Rev., 1937, [ii], 51, 61; cf. A., 1937, I, 553).—Different methods have been worked out for the evaluation of the distribution function as determined by the *X*-ray scattering curve. When applied to the determination of the no. of atoms around any atom in molten KCl and LiCl the results indicate that for the next neighbours the co-ordination found in the solid is maintained for the liquid, but that the distribution of the second next neighbours is already disturbed. L. S. T.

Dependence of diffuse scattering of *X*-rays from quartz on the crystal orientation. II. E. S. FOSTER, jun., G. E. M. JAUNCEY, and W. A. BRUCE (Physical Rev., 1937, [ii], 51, 61).—The coherent part of *X*-rays diffusely scattered from a crystal $\propto (1-\epsilon)^{-2M}$, where M, the Debye–Waller temp. factor, is a measure of the mean square displacement of the atoms. The structure of quartz as determined by *X*-ray analysis is very complicated, and a no. of rules concerning the symmetry of the diffuse scattering from an *X*-cut crystal has been established. L. S. T.

New type of mixed halogen–oxygen lattice. L. G. SILLÉN (Naturwiss., 1938, 26, 612—613).—Bi_2O_3 dissolves readily in molten LiCl, and when excess of the latter is removed by H_2O, $LiBi_3O_4Cl$, which crystallises in colourless, tetragonal plates, remains. The Laue, rotation, and powder diagrams of this substance indicate that it has a new type of mixed halogen–O lattice. $LiBi_3O_4Br_2$ and $LiBi_3O_4I_2$ have similar lattices. A. J. M.

Theory of orientation separation of ionic crystals. I. N. STRANSKI and L. KRASTANOV (Monatsh., 1938, 72, 76; cf. A., 1938, I, 299).—A correction. J. W. S.

Orientation of liquid crystals by heat conduction. D. O. HOLLAND and G. W. STEWART (Physical Rev., 1937, [ii], 51, 62; cf. A., 1936, 670).—Former results concerning a definite effect on the orientation of liquid cryst. *p*-azoxyanisole by heat conduction have been checked by the photographic densities of the *X*-ray halo with different vertical alterations in temp. gradients. The new results favour the view that orientation is produced by heat conduction. L. S. T.

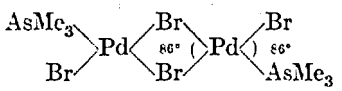
Geometric derivation from lattice dimensions of the range of action of ions in crystal structures. A. PITSCHUGIN (Z. Krist., 1938, 99, 251—263).—Ionic domains are defined in terms of null potential loci, and need not be spherical. Radii of those for 61 elements are found by analysis of certain cubic crystal types. In comparison with standard data (Pauling, Goldschmidt, Rinne) the new vals. show a smaller difference between at. and ionic radii, whilst cationic are usually > anionic radii. I. McA.

Crystalline configurations of electrolytic lead deposited from nitrate solutions. S. YAMAMORI

and S. YOSHIMOTO (Mem. Coll. Sci. Kyoto, 1938, **A**, **21**, 75—84).—*X*-Ray Laue diffraction patterns indicate that the Pb micro-crystals tend to be deposited fibrously, with one of the [211] axes in common. The direction of max. growth does not always coincide with the direction of the fibrous axis. In most cases there are two growths of micro-crystals incompletely rotating around the same common [211] axis.

N. M. B.

Crystal structure of certain bridged palladium compounds. A. F. WELLS (Proc. Roy. Soc. 1938, **A. 167**, 169—189).—The structures of the compound $(AsMe_3)_2Pd_2Cl_4$ and its Br analogue have been determined. Crystals of the tetrachloride from EtOH and dioxan and of the tetrabromide from dioxan are all isomorphous. The mol. is planar, with the configuration:



The distance Pd—Br is 2·45, Pd—As 2·50 A. The mols. are packed into the tetragonal cell in such a way as to produce tunnels in the crystals which may remain empty or may take up solvent with a small change of cell size and reorientation of the mol. G. D. P.

Structure of aromatic compounds. IV. Space-group and atomic arrangements in phloroglucinol dihydrate. K. BANERJEE and R. AHMAD (Indian J. Physics, 1938, **12**, 249—258).—The cell dimensions are *a* 6·80, *b* 8·103, *c* 13·70 A. From oscillation photographs about *a* and *b* the space-group is *Pnnm*. $d = 1{\cdot}394$ g./c.c.; 4 mols. per cell. Measurements of magnetic susceptibilities by BHATTACHARJEE (unpublished) lead to the conclusion that the mols. lie nearly parallel to the {103} planes and the mol. arrangement suggested is in accordance with this and the space-group. T. H. G.

***X*-Ray investigation of atomic vibrations in magnesium between 86° and 293° K.** G. W. BRINDLEY and P. RIDLEY (Proc. Physical Soc., 1938, **50**, 757—766).—Measurements of the intensities of *X*-ray reflexions from Mg powder, and abs. vals. of the intensity ratio I_{86}/I_{293} obtained from comparative measurements on Mg–Al powders, are reported. A discussion of results in relation to theoretical work on the effect of lattice vibrations in hexagonal metals on the intensities of *X*-ray reflexions shows that in Mg the lattice vibrations are almost isotropic, but that the mean at. displacements in the basal plane are ~3% > those parallel to the *c* axis. Calc. vals. are given and are also expressed in terms of characteristic temp. of 339° and 327° parallel and perpendicular, respectively, to the *c* axis. These results for Mg and for other hexagonal metals point to a correlation between the departure of the axial ratio from the ideal val. 1·633 and the asymmetry of the lattice vibrations.

N. M. B.

Scattering of *X*-rays in liquids, in particular triacylamines. R. N. BAPAT (Z. Physik, 1938, **110**, 389—392).—A no. of tri-*n*- and -*iso*-amines (C_{2-5}), and mono- and di-*iso*amylamine, have been examined by a method to be published. The larger variation in *d* is not explicable, and the conclusions reached in the previous work do not apply.

L. G. G.

Test of alternative structures proposed for cellulose. S. T. GROSS and G. L. CLARK (Z. Krist., 1938, **99**, 357—366).—Using a modified Sauter camera, transmission, rotation, and Sauter *X*-radiograms have been made for variously oriented cellulose structures (tunicin, bacterial cellulose, and *Valonia ventricosa*). Comparison with the patterns expected from the Meyer–Mark (A., 1937, I, 502) and Sauter (A., 1937, I, 226) cells favours the former. I. McA.

Crystal structure of the trimethylstibine dihalides, Me_3SbX_2. A. F. WELLS (Z. Krist., 1938, **99**, 367—377).—The isomorphous $SbMe_3X_2$ (X = Cl, Br, and I) have 2 mols. per hexagonal cell with *a* 7·27, 7·38, and 7·53, *c* 8·44, 8·90, and 9·59 A., respectively; space-group $C\bar{6}2c$—D^4_{3h}; ρ —, 2·58, and 2·97. Complete at. parameters and interdistances, determined by Fourier and other methods from oscillation and Weissenberg *X*-radiograms (visual intensities), give a triangle of 3 Me with the central coplanar Sb bisecting the perpendicular X–X. X is equidistant from 6 Me. Sb—X and X—X distances indicate, in accord with physical and chemical properties, a form intermediate to the ionic X′(SbMe$_3$)$^{\cdot\cdot}$X′ and the mol. with 5-covalent Sb.

I. McA.

Law of twinning and regular intergrowth of most densely packed spheres. G. MENZER (Z. Krist., 1938, **99**, 378—409; cf. Schaacke, A., 1938, I, 234, 350).—Crystallo-geometrical. With a view of application to the submicroscopic twinning in metal foil, a mathematical treatment of twinning in the three cubic space-lattices is developed in terms of a common cube-shaped superlattice. Cases specially considered include the densest (cubic and hexagonal) packings of spheres, and lattice faults in the contact range of the twins. I. McA.

Structure of thin nickel and silver layers. G. MENZER (Z. Krist., 1938, **99**, 410—443; cf. preceding abstract).—Results of Brück (A., 1936, 784) and of Cochrane (*ibid.*, 1327) for the electron diffraction of metal films show, in addition to the normal pattern, two types of "irrational points." The first type has been interpreted by Laue (A., 1937, I, 351). Theory developed shows the second type to be due to submicroscopic twinning about (111) planes. I. McA.

Induced and spontaneous change of molecular arrangement in stretched rubber. P. A. THIESSEN and W. WITTSTADT (Z. physikal. Chem., 1938, **B**, **41**, 33—58).—The mol. arrangement in stretched rubber is investigated by methods of double refraction and *X*-rays. It is a function of temp., extension, and velocity and duration of preliminary stretching. The results indicate that in stretched rubber a "Mehrstoff-system" exists, in which crystals and melts exist within a wide temp. range in pressure-dependent equilibrium. The intrinsic and characteristic properties of rubber may be deduced from these considerations. W. R. A.

Crystal structure and molecular structure of bromotricyanomethane. W. FENSCH and G.

WAGNER (Z. physikal. Chem., 1938, **B**, **41**, 1—14).—*X*-Ray measurements by the rotating-crystal method indicate, for $CBr(CN)_3$, a rhombic elementary 8 mol. cell: J_{100} 6·05 A.; J_{010} 11·33 A.; J_{001} 17·17 A.; $d = 1·8$; mol. wt., 169·94. The space-group is V_h^{11} and the symmetry is V_h. The 8 Br lie in one plane with the parameters x 0·197, y 0·229, z 0·181; the probable symmetry of the residual $C(CN)_3$ is C_s. On the basis of these results a structure for $CBr(CN)_3$ is proposed and discussed. W. R. A.

Preparation and crystal structure of some alkali aluminium fluorides of the type $TlAlF_4$. C. BROSSET (Z. anorg. Chem., 1938, **239**, 301—304).—$KAlF_4$, NH_4AlF_4, and $RbAlF_4$ are isomorphous with $TlAlF_4$, and have a 3·550, c 6·139 A., a 3·615, c 6·261 A., and a 3·587, c 6·346 A., respectively. An improved method for the prep. of the K salt is described; the *Rb* salt is apparently new. F. J. G.

Metallic amides and metallic nitrides. V. Crystal structures of Cu_3N, GaN, and InN. R. JUZA and H. HAHN (Z. anorg. Chem., 1938, **239**, 282—287).—Cu_3N is cubic with a 3·807 A., one mol. in the unit cell, space-group O_h^1. GaN and InN are hexagonal, wurtzite lattice, space-group C_{6v}^4 with a 3·180, c 5·166 A., and a 3·533, c 5·693 A., respectively. At. positions are given. F. J. G.

X-Ray investigations of organo-metallic compounds. I. Silicon, tin, and lead tetraphenyl. G. GIACOMELLO (Gazzetta, 1938, **68**, 422—428).—From *X*-ray measurements the following vals. of the distance between the central atom and a C are calc. for $SiPh_4$, $SnPh_4$, and $PbPh_4$, respectively: 1·88, 2·07—2·08, 2·39 A. These agree well with the vals. calc. from Pauling's at. radii. O. J. W.

New form of resorcinol. I. Structure determination by *X*-rays. II. Thermodynamic properties in relation to structure. J. M. ROBERTSON and A. R. UBBELOHDE (Proc. Roy. Soc., 1938, **A**, **167**, 122—135, 136—147).—I. At about 74° α-$C_6H_4(OH)_2$ transforms into a denser modification (β) the structure of which has been determined. It is orthorhombic, the unit cell containing 4 mols., $d_{calc.}$ 1·327. The analysis shows that the C_6 ring is apparently a regular hexagon but that the OH are displaced from the symmetrical positions and that one at least is not in the plane of the ring.

II. The unusual fact of the existence of the denser modification at high temp. is discussed in the light of the crystal structure. The open α-structure is maintained by OH bonds; transition to the denser β-structure is accompanied by distortion of these bonds and of the mol. The prep. of the two forms is described and the heat of transition is determined. The temp. of transition of $C_6H_4(OH)_2$ is about 2° < that of $C_6H_4(OD)_2$. The vol. changes from liquid to solid are investigated and some preliminary work on the change from tetragonal to cubic pentaerythritol is described. G. D. P.

Diffraction of *X*-rays in organic glasses. T. M. K. NEDUNGADI (Proc. Indian Acad. Sci., 1938, **8**, **A**, 65—72).—The *X*-ray diffraction of glycerol, salol, and $COPh_2$ has been examined in the liquid (I) and glassy (II) states. The change from (I) to (II) is accompanied by a large decrease in the scattering at small angles, a definite sharpening of the haloes, and a widening of the haloes. The first two effects are explained on the basis of the large decrease in the compressibility of the substances in passing from (I) to (II), whilst the third effect is attributed to the decrease of the intermol. distance which results from the closer packing of the mols. in (II). W. R. A.

Structure of glassy selenium. K. LARK-HOROVITZ and E. P. MILLER (Physical Rev., 1937, [ii], **51**, 380).—The diffraction pattern obtained with thin rods of glassy Se has three bands, the $\lambda/2 \sin\theta$ of which are equal to 3·42, 1·73, and 1·13, in agreement with vals. obtained for liquid Se (A., 1937, I, 119). The three sharp peaks found in the distribution curve correspond with distances of 2·32, (3·46, 3·69), and 4·34 A. for next neighbours in the crystal. The no. of atoms at these distances also corresponds with the no. of atoms in the crystal. L. S. T.

Electron diffraction patterns of sulphur and selenium molecules. J. D. HOWE and K. LARK-HOROVITZ (Physical Rev., 1937, [ii], **51**, 380).—The diffraction of electrons from S and Se vapour at low temp. has been investigated. The pattern for S differs from that described previously (*ibid.*, 1936, **49**, 199) and cannot be interpreted on the basis of a diat. mol.; a puckered ring S_8 structure adequately describes the results. The pattern for Se is similar to that obtained for S, and a structure like that for S, but corresponding with Se_6, is preferred. L. S. T.

Temperature variation of electron diffraction patterns of some organic films. K. TANAKA (Mem. Coll. Sci. Kyoto, 1938, **A**, **21**, 85—88).—Diffraction pattern photographs show that with rise of temp. the parallel arrangement of the mols. is gradually destroyed and finally becomes haphazard. The transition temp., as shown for grease, vaseline, and two paraffins, varies for different substances and for different film thicknesses. Temp.-η curves show a smooth fall with rise of temp. and no discontinuity at the transition temp. N. M. B.

Diffraction of electrons by cellulose nitrate. V. A. KARGIN, V. KARPOV, and Z. PINSKER (Acta Physicochim. U.R.S.S., 1937, **7**, 646—647).—Four diffraction rings were observed when a beam of fast electrons was passed through a thin film of cellulose trinitrate. The results agreed with those found by *X*-rays and were characteristic of the trinitrate. The lines in the electron photographs were no sharper than those obtained with *X*-rays. This broadening of the lines is due to crystal imperfections, and it is suggested that the structure is not strictly regular, but there are statistical variations in the disposition of glucose chains. J. A. K.

Estimation of interatomic distances in AX_3 and AX_4 halides from electron diffraction measurements. O. HASSEL and A. SANDBO (Z. physikal. Chem., 1938, **B**, **41**, 75—85).—From electron diffraction measurements, the interat. distances and the valency angles in AX_3 and AX_4 halides have been estimated. The difference between the vals. obtained and those calc. from the Pauling–Huggins

radii are large for Si compounds. AsX_3 has a valency angle > SbX_3. The valency angle for each of the elements studied increases with increasing at. wt. of the halogen. W. R. A.

Structure of electrically polished copper surfaces. K. H. MOORE (Ann. Physik, 1938, [v], **33**, 133—137; cf. A., 1937, I, 19).—The structure of electrolytically polished Cu surfaces has been investigated by electron diffraction. The surface consists of plates of Cu_2O. At a dodecahedron surface the plates are oriented with their cube edges parallel to the cube edges of the Cu. At a cubic surface the plates are not uniformly oriented. The most frequent orientation is with the octahedral plane of the Cu_2O parallel to the cube plane of the Cu in such a way that a surface diagonal of the Cu_2O is approx. parallel to a cube edge of the Cu. O. D. S.

Submicroscopic twinning of some metals. F. KIRCHNER and H. CRAMER (Ann. Physik, 1938, [v], **33**, 138—142; cf. A., 1938, I, 17).—A max. intensity of the irregular interference points in the electron diffraction patterns of oriented Cu films is observed at a film thickness of about 20 mμ. Irregular interference points have been observed in the pattern of a natural Cu crystal. The irregular interference points are due to repeated twinning at the octahedral plane and are characteristic of face-centred crystals. With increasing thickness of the film the primary orientation is reinforced. O. D. S.

Diffraction of electrons by oxide-coated cathodes. J. A. DARBYSHIRE (Proc. Physical Soc., 1938, **50**, 635—641).—Electron diffraction methods were used to examine Ni cathodes coated with a solid-solution paste of $BaCO_3$–$SrCO_3$, and arrangements were made to fire off getter pellets at suitable stages of the activation. After activation by heat-treatment to give good emission, the cathodes gave patterns of SrO alone when no getter had been fired off, and patterns of MgO and SrO when the getter pellet (Ba–Mg alloy) had been fired. Cathodes consisting of $BaCO_3$ alone before activation gave patterns of BaO after activation, whereas $SrCO_3$ cathodes gave SrO patterns. N. M. B.

Electron-optical investigation of the penetration of slow electrons (0 to 200 volt) through metal foils. Penetration of slow electrons (0 to 200 volt) through metal foils. H. KATZ (Ann. Physik, 1938, [v], **33**, 160—168, 169—184; cf. A., 1938, I, 109).—I. Electron-microscopic investigations show that chemically prepared Ag foils about 1000 A. thick are transparent to slow electrons over the whole surface. With 10-v. electrons images can be formed of objects behind the foil, showing that the electrons penetrate the foil without change in direction. The transparency of the films is increased by electron bombardment.

II. Measurements have been made of the transparency of chemical Ag foils for electrons up to 200 v. At velocities >30 v. the transmitted electrons consist of two groups with velocities, respectively, equal to and < the primary velocity. A max. in the transparency with respect to electrons of unchanged velocity is observed at a velocity which is the lower the greater is the transparency of the film. O. D. S.

Domain theory of ferromagnetics under stress. III. Reversible susceptibility. W. F. BROWN, jun. (Physical Rev., 1938, [ii], **54**, 279—287; cf. A., 1938, I, 301).—The statistical theory previously developed is extended to give formulæ for the magnetisation curve and other properties of an ideal reversible specimen and is applied to actual specimens. This leads to the formula for the reversible susceptibility of Ni and Fe proposed and verified by Gans but not hitherto deduced. By taking into account the anisotropy of the domains, satisfactory expressions for Co are found. N. M. B.

Magnetic viscosity in iron. C. W. HEAPS (Physical Rev., 1938, [ii], **54**, 288—293).—Magnetic viscosity (change of induction after the magnetising field has ceased to vary) measured in a bar of commercial Fe, with elimination of switch sparking complications, depends on previous magnetic states. This indicates that reversible domains can retain their lagging propensity while the magnetic force is varying over a considerable range. The viscous effect depends on the magnitude of the previous induction for vals. of the latter >60 gauss. There is evidence that the movement of the boundaries of saturated domains is subject to time-lag. N. M. B.

Optical properties of the alkali metals. R. W. WOOD and C. LUKENS (Physical Rev., 1938, [ii], **54**, 332—337; cf. A., 1933, 1096).—The physical processes responsible for the unique optical properties of Ag, in contrast to those of the alkali metals, are discussed on the basis of the zone theory of electron distribution in crystals. Photographs of the spectra of the discharge of a condenser through a capillary tube after reflexion from alkali metal films condensed at liquid-air temp. showed no renewal of reflecting power in the remote ultra-violet to 500 A. N. M. B.

Crystalline nickel sulphate α-hexahydrate. (A) Optical activity. N. UNDERWOOD, F. G. SLACK, and E. B. NELSON. **(B) Magneto-optical activity.** F. G. SLACK, R. T. LAGEMAN, and N. UNDERWOOD (Physical Rev., 1938, [ii], **54**, 355—357, 358—360).—(A) Visual and photographic measurements of the optical activity in the region 4200—6500 A. were made. Both right- and left-hand crystals are found and the rotatory dispersion curves show anomalous rotatory dispersion. Using Drude's equation the observed anomaly is predicted as due to absorption bands at 3954 and 7187 A., respectively; the presence of these is shown by transmission data for the crystal, in agreement with absorption data for solutions.

(B) The dispersion of the Verdet const. was measured over the visible range of the spectrum, and the temp. effect was investigated over a small temp. range. The magnetic rotatory dispersion curve may be fitted by a single-term electronic dispersion equation as suggested by Drude, and calculation indicates an active absorption band at 964 A. The Verdet const. is inversely ∝ abs. temp. in the range measured. N. M. B.

Molecular rotation of the modifications of hydrogen in the solid state. K. SCHÄFER (Naturwiss., 1938, **26**, 563—564).—Theoretical. The effect of a potential field in the crystal on the energy levels of the rotational states $l = 0$ and $l = 1$ is calc. on the basis of quantum mechanics. A. J. M.

Variation of the elastic constants of crystalline sodium with temperature between 80° and 210° K. S. L. QUIMBY and S. SIEGEL (Physical Rev., 1938, [ii], **54**, 293—299).—Methods are described for growing Na single-crystal rods 4·7 mm. by 10 cm., for handling them in an atm. of He, and for measuring the principal elastic moduli at low temp. Vals. of the adiabatic and isothermal moduli and consts. are tabulated at 10° intervals for 80—210° K. The Debye characteristic temp., calc. from the elastic consts. at 80° K., is 164° K. N. M. B.

Explanation of the connexion between modulus of elasticity and damping for ferromagnetic substances. M. KORNETZKI (Wiss. Veröff. Siemens-Werken, 1938, **17**, 48—62).—It is shown that the relationship between extension and strain for a ferromagnetic substance behaves like the magnetisation with respect to magnetic field strength. For small strains the modulus of elasticity decreases linearly with increasing strain. The log decrement increases linearly with the strain. A relationship between the decrease in the modulus of elasticity and the increase in damping is put forward. A. J. M.

The α-β transformation of quartz. H. E. VON STEINWEHR (Z. Krist., 1938, **99**, 292—313).—A full account of work already reported (A., 1937, I, 402). I. McA.

Changes of resistance of pure metals in a magnetic field. M. KOHLER (Naturwiss., 1938, **26**, 630; cf. A., 1938, I, 302).—A relationship between the effects of temp. and field strength on the variation of resistance of pure metals in a magnetic field can be derived theoretically on the basis of the assumption that a definite collision time can be assigned to electrons dependent on temp. and purity of the metal. Data obtained for the resistance change of W at 1·57—20·4° K. with variation of magnetic field strength by de Haas *et al.* (A., 1938, I, 349) give a linear relationship between $\log \rho/\rho_0$ and $\log H/\rho_0$. A. J. M.

Superconductivity of thin films of mercury. E. T. S. APPLEYARD and A. D. MISENER (Nature, 1938, **142**, 474).—Hg films deposited at 64° K. and annealed at 90° K. are practically uniform and coherent when >400 A. thick. Their resistivity approaches closely that of the bulk metal. In agreement with Shalnikov's results for annealed Pb and Sn (A., 1938, I, 452), their transition temp. in zero magnetic field (4·14° K.) approximates to that of the bulk metal, and the films show high magnetic threshold fields. When the field is applied parallel to the plane of the film, resistance is completely restored over a considerable range of magnetic field; the first onset of resistance is sharp. The dependence of this onset field on temp. is shown graphically for films 392, 1034, and 9120 A. thick. The field changes by a factor >15 on passing from the thinnest to the thickest film. L. S. T.

Atomistic explanation of superconductivity. U. DEHLINGER (Naturwiss., 1938, **26**, 593—594).—The sudden change in sp. heat at the onset of superconductivity can be explained by assuming that below the threshold temp. there is an increasingly regular distribution of the spin of the valency electrons as the temp. decreases. This explains the observed magnetic effect, especially the effect of a field on the transition temp., the Meissner–Ochsenfeld effect, and the paramagnetic effect on switching off the field. The hypothesis is further developed to explain the disappearance of electrical resistance. A. J. M.

Magnetic properties of anhydrous nickel chloride and the laws of variation of paramagnetism. P. LAURENT (J. Phys. Radium, 1938, [vii], **9**, 331—336).—The magnetisation of sublimed anhyd. $NiCl_2$ has been accurately determined between 15° and 450°. The coeff. of magnetisation, plotted as a function of the temp., can show one of two forms depending on the previous thermal treatment of the sample. It may consist of two straight lines, a high-temp. line characterised by a moment of 17·2 magnetons and a low-temp. line of 16·4 magnetons, meeting near 250°, or the straight line at low temp. may continue as a curve above 250°. The curved region, which corresponds with a metastable state of $NiCl_2$, is attributed to the existence of several moments. W. R. A.

λ Transition point of the magnetic susceptibility of manganous oxide, MnO. H. BIZETTE, C. F. SQUIRE, and B. TSAÏ (Compt. rend., 1938, **207**, 449—450; cf. A., 1934, 14).—Data for χ at 10—300° K. are recorded. Above the transition point (T^0_λ = 117° K.) the variation of χ with T is normal, χ being independent of H. The paramagnetism is due to spin; Curie const. 4·40, Curie point −610° K., p_B 5·95. Below T^0_λ, χ decreases rapidly with decreasing temp., and increases with H, probably owing to exchange forces which restrict the spin (cf. Bitter, A., 1938, I, 438). A. J. E. W.

Principal paramagnetic susceptibilities of potassium ferricyanide at low temperatures. L. C. JACKSON (Proc. Physical Soc., 1938, **50**, 707—710).—Measurements previously reported (cf. A., 1933, 766) were repeated and extended to 14·2° K. Two of the principal susceptibilities are approx. equal over the range 290—14° K., but that along the third principal axis is considerably smaller. The anisotropy is almost 400% at 14° K. and is still increasing as the temp. falls. A brief comparison with Howard's theory (cf. A., 1936, 148) is made. N. M. B.

Paramagnetism of the ferromagnetic elements. W. SUCKSMITH and R. R. PEARCE (Proc. Roy. Soc., 1938, **A**, **167**, 189—204).—The method consists in measuring the force on a specimen placed in an inhomogeneous magnetic field. The apparatus allows the determination to be carried out in a controlled atm. or in vac. at temp. up to 1500°. Accurate vals. of the susceptibilities of Fe, Co, and Ni are obtained, whence the magneton nos. are deduced. Existing theory is inadequate to explain the experimental results. G. D. P.

Entropy and magnetic susceptibility of paramagnetic salts below 1° K. M. H. HEBB and E. M. PURCELL (Physical Rev., 1937, [ii], **51**, 384).—Results of other investigations on the production of very low temp. by the adiabatic demagnetisation method are discussed. L. S. T.

Magnetism and molecular constitution of some chromium compounds. S. S. BHATNAGAR, B. PRAKASH, and A. HAMID (J.C.S., 1938, 1428—1434).—The susceptibilities of various Cr compounds have been determined, using a modified form of Gouy's balance, and are compared with calc. vals. CrO_2 contains Cr^{IV}; $AgCrO_4$ and the C_5H_5N salt of perchromic acid contain Cr^{VI}. The constitution of a complex Cr sulphate has been confirmed, and more satisfactory constitutions are suggested for triamminochromium tetroxide, and the C_5H_5N and quinoline salts of tetrachlorohydroxychromic acid. The three isomerides of dichloroaquotriamminochromic chloride have also been examined. W. R. A.

Magnetism, a modern aid to the organic chemist. E. MÜLLER (Angew. Chem., 1938, **51**, 657—663).—Published work is reviewed. E. S. H.

Absorption measurements of ultrasonic waves in aqueous solutions. W. BUSS (Ann. Physik, 1938, [v], **33**, 143—159).—Investigation by optical interferometry of the sound field in H_2O does not lead to the possibility of measurement of the sound intensity. The absorption of ultrasonic waves of frequencies from 2100 to 6500 kHz. in aq. solutions of sucrose, glycerol, $MgSO_4$, Na_2SO_4, NaCl, and NH_4Cl has been determined by measurement of the sound pressure by means of a variable condenser with one light, moving plate. Vals. are not in agreement with the absorption formula of Stokes and Kirchhoff and differ from those of Claeys *et al.* (A., 1937, I, 122). O. D. S.

Refractive indices of liquid helium I and helium II. H. E. JOHNS and J. O. WILHELM (Canad. J. Res., 1938, **16**, **A**, 131—132).—The vals. for He I are $1{\cdot}0206\pm0{\cdot}0012$ at 4·2° K. and $1{\cdot}0269\pm0{\cdot}0004$ at 2·26° K., and for He II $1{\cdot}0269\pm0{\cdot}0004$ at 2·18° K., all obtained for λ 5461 A. There is no measurable difference between the vals. for He I and II at temp. at which they have the same d, and it follows that they have the same mol. refractivity. C. R. H.

Relation between b.p. and refractivity. M. M. SAMIGIN (J. Phys. Chem. Russ., 1938, **11**, 325—330).—Empirical relations are found between b.p. and $[R]$ or n of series of homologues. J. J. B.

Specific heat of nickel from 100° to 600°. C. SYKES and H. WILKINSON (Proc. Physical Soc., 1938, **50**, 834—851).—Full data are tabulated and plotted for the determination of the sp. heat–temp. curves for four different types of Ni, and the effects of method of manufacture, heat-treatment, and chemical composition were investigated. All available data are reviewed, and an attempt is made to evaluate the most probable C_p–T curve for Ni in the range 100—600°. N. M. B.

Heat capacity at constant volume of the system ethylene near the critical temperature and pressure. D. B. PALL, J. W. BROUGHTON, and O. MAASS (Canad. J. Res., 1938, **16**, **B**, 230—241).—The heat capacity in the immediate neighbourhood of the crit. temp. is a function of the previous thermal treatment of the system. It is shown that a large amount of mol. interaction exists in the crit. region both in the condensed phase and, to a smaller extent, in the vapour phase. C. R. H.

Measurements of the kinetic and calorific properties of gaseous helium at the temperature of liquid helium. A. VAN ITTERBECK (J. Phys. Radium, 1938, [vii], **9**, 313—318).—The methods used for the determination of sp. heat and η of He at the temp. of liquid He are described; the results obtained agree with the existing theory of gases at low temp. The measurements agree with the Uehling theory (A., 1935, 157) and indicate the validity, at low pressures, of Maxwell's law for the distribution of velocities of the mols. W. R. A.

Specific heats of organic vapours. P. FUGASSI and C. E. RUDY, jun. (Ind. Eng. Chem., 1938, **30**, 1029—1030).—The Einstein functions in Bennewitz and Rossner's sp. heat equation (A., 1938, I, 303) are expressed as function of T of the form $\Gamma_0 + \Gamma_1 T + \Gamma_2 T^2$, enabling C_p for an org. vapour to be expressed as an explicit function of T of the usual type. Vals. of Γ_0, Γ_1, and Γ_2 are deduced from the structural formula. Calc. vals. of C_p for C_6H_6 are in agreement with experiment. A. J. E. W.

New thermodynamical conception of entropy. E. HEGELMANN (Wärme, 1938, **61**, 579—585, 599—605, 615—620).—Mathematical. R. B. C.

Calorimetric measurements at the transition from the anisotropic to the isotropic liquid phase. C. KREUTZER (Ann. Physik, 1938, [v], **33**, 192—209).—The sp. heats of *p*-azoxyanisole, *p*-azoxyphenetole, and *p*-azoxyanisole–phenetole in the isotropic and anisotropic states and the corresponding heats of transition have been measured by a differential method. The sp. heat in the anisotropic phase is in all cases > in the isotropic phase. O. D. S.

Evaporation coefficient of water. H. MACHE (Z. Physik, 1938, **110**, 189—196; cf. A., 1937, I, 607).—The magnitude of the coeff. is affected by traces of solutes derived from the glass vessel, and dissolved gases. A new method is described which obviates this by measuring the rate of expansion of vapour bubbles from a cylindrical boiling nucleus suspended below the surface of superheated H_2O. L. G. G.

M.p. of high-purity silicon. M. L. V. GAYLER (Nature, 1938, **142**, 478).—The m.p. of 99·93% Si (Al 0·02, Fe 0·02, Ca 0·02, insol. 0·01%) is $1415°\pm2°$ (cf. A., 1938, I, 21). L. S. T.

Empirical relationship between m.p. and number of carbon atoms for higher normal paraffins. C. D. NENITZESCU, S. TITEICA, and I. IRIMESCU (Naturwiss., 1938, **26**, 629).—The m.p. (°C.) and no. (n) of C atoms in the higher normal paraffins (C_{25}—C_{70}) are connected by the relationship m.p. $= 32-0{\cdot}56n + 15{\cdot}84(n - 19{\cdot}7)^{\frac{1}{2}}$. The m.p. of all normal paraffins from C_{25} to C_{80} are calc. A. J. M.

II ⇌ III change in solid hydrogen sulphide, H_2S and D_2S, under a pressure of 250 kg. per sq. cm. K. CLUSIUS and K. WEIGAND (Z. Elektrochem., 1938, **44**, 674—679).—The vol. difference for the two modifications, $V_{II} - V_{III}$, is $0{\cdot}22 \pm 0{\cdot}08$ and $0{\cdot}18 \pm 0{\cdot}08$ c.c. per mol. for H_2S and D_2S, respectively. Hysteresis increases with pressure and possibly affects the transformation mechanism, theories of which are discussed. C. R. H.

Complexity of phosphorus pentoxide. II. A. SMITS, J. A. A. KETELAAR, and J. L. MEYERING (Z. physikal. Chem., 1938, **B**, **41**, 87—97).—The v.p. of metastable liquid P_2O_5 between 260° and 360° is 4—17 mm. Hg higher when determined with SiO_2 than with glass apparatus. When the liquid volatilises there is a disturbance of equilibrium to form the stable solid modification, and the observed v.p. is < the true v.p. Glass is five times as active catalytically as SiO_2 with respect to this liquid–solid transition. By means of an indirect method the true v.p. of the liquid form has been calc. V.d. determinations indicate that the vapour of both forms is bimol. but a small amount of association to a quadrimol. state occurs with the vapour of the liquid form. C. R. H.

Complexity of aluminium chloride. A. SMITS and J. L. MEYERING (Z. physikal. Chem., 1938, **B**, **41**, 98—111).—V.p. data for the solid and liquid, respectively, satisfy the equations $\log p = -6000/T + 15{\cdot}115$, and $\log p = -2070/T + 6{\cdot}678$, where p = pressure in cm. From the data the following have been calc.: sublimation temp. at 1 atm., 180·2°; metastable b.p. of the liquid, 159°; mol. heat of sublimation, 27·4 kg.-cal.; mol. heat of evaporation, 9·5 kg.-cal.; mol. heat of fusion, 17·9 kg.-cal.; mol. sublimation entropy, 60; evaporation entropy, 22. No evidence of a second modification has been obtained. V.d. determinations indicate that the gas is Al_2Cl_6. Dissociation data agree with those of Fischer and Rahlfs (A., 1932, 565). The solid phase consists of at least two pseudo-components, and after sublimation a less volatile residue remains and an abnormally low v.p. is observed. Rapid condensation of vapour yields a sublimate which, for a time, exhibits a high v.p. A possible structure of the pseudo-components based on the cryst. structure of $AlCl_3$ is suggested. C. R. H.

Thermal diffusivity of nickel. C. STARR (Physical Rev., 1937, [ii], **51**, 376—377).—The thermal diffusivity of Ni (>99·98%, ρ 8·79 g. per cm.³) after annealing in H_2 at 870° is 0·15885 cm.² per sec. (±0·06%) at 25°. The corresponding thermal conductivity is 0·618 w. per cm. per degree. L. S. T.

Dependence of the coefficient of thermal conductivity of gases and vapours on the pressure. N. VARGAFTIK (Tech. Phys. U.S.S.R., 1937, **4**, 341—360).—Using the hot-wire method, measurements have been made of the thermal conductivity of N_2 up to 90 atm. and of steam up to 30 atm. The coeff. of thermal conductivity, λ, increases with increase of pressure. The val. of λ for steam increases with temp. and the val. of the const. K in the expression $\lambda = KC_v\eta$ also increases with temp. K also decreases with increase in pressure. C. R. H.

Heat-conduction in a medium having thermal properties depending on the temperature. M. R. HOPKINS (Proc. Physical Soc., 1938, **50**, 703—706).—Mathematical. Typical standard calculations are modified to allow for the variation with temp. of the thermal properties of the medium. N. M. B.

Application of the viscosity formulæ of E. Andrade and S. Chaikin to fused salts. A. A. LEONTIEVA (J. Phys. Chem. Russ., 1938, **11**, 310—316).—The equations of Andrade (cf. A., 1934, 356) and Chaikin (cf. A., 1937, I, 125) satisfy many viscosity data of borates, phosphates, etc. J. J. B.

Structure viscosity in softening vitreous selenium. E. JENCKEL (Kolloid-Z., 1938, **84**, 266—268).—Structure viscosity is observed and can be expressed by Philippoff's equation (A., 1935, 692). E. S. H.

Effect of temperature on the internal viscosity of non-polar gases. A. W. MÜLLER (Wiss. Veröff. Siemens-Werken, 1938, **17**, 33—37).—It is shown that at the same reduced temp. (T_r) the reduced internal viscosity (η_r) for all non-polar gases is the same, and an expression connecting T_r with η_r is given. A. J. M.

Internal friction of metallic crystals. T. A. READ (Physical Rev., 1938, [ii], **54**, 389).—The observed longitudinal decrements of single crystals of Cu, Pb, and Sn are < those of the polycryst. form, indicating that the internal friction is less in the single crystals. The effect of internal strain is discussed. N. M. B.

Transfer effect in liquid helium II. J. G. DAUNT and K. MENDELSSOHN (Nature, 1938, **142**, 475; cf. A., 1938, I, 397, 511).—The rate of transfer of liquid He II on glass depends only on temp. and is practically independent of the difference in height between two levels. Hence the rate of transfer is a characteristic quantity depending only on the thermal state of liquid He II. The rate of transfer on polished Cu, but not on drawn Cu wire, is the same as that on glass. The He film in which transfer takes place is approx. 5×10^{-6} cm. and appears not to change in order of magnitude between 2·1° and 1·5° K. Above the λ point it is $> 10^{-7}$ cm. thick. The heat transport can be accounted for by actual flow of He along the surface in the direction towards higher temp. L. S. T.

Emanation methods. I. Thermal behaviour of alkaline-earth carbonates. II. Possibility of determining diffusion constants and particle size from emanation properties. K. E. ZIMENS (Z. Elektrochem., 1938, **44**, 590—594).—I. Examples are given of the application of emanation methods (cf. A., 1937, I, 403, 605).

II. A preliminary account of the derivation of a formula connecting emanation properties with diffusion consts. and particle size. C. R. H.

Diffusion of water of crystallisation. H. KRAFT (Z. Physik, 1938, **110**, 303—309).—Diffusion of H_2O of crystallisation is measured by suspending various crystals in an atm. of D_2O approx. = v.p. of H_2O at the crystal surface. The crystal is transferred to a vac., the total H_2O and D_2O pumped into a

discharge tube, and the intensity difference between the H_α and D_α lines measured. The diffusion coeff. is very small and approx. = coeff. of self-diffusion of metals as found by Hevesy. From the temp. coeff. of the diffusion velocity, the activation energy is 6000 g.-cal. per mol. L. G. G.

Isotherms and isobars of the nitrogen–carbon monoxide system. N. Torocheshnikov (Tech. Phys. U.S.S.R., 1937, **4**, 365—369).—Isothermal and isobaric data are tabulated and an equation is derived from which data for the equilibrium in the N_2–CO system can be calc. C. R. H.

Viscosity of ideal mixtures. A. Batschinski (J. Phys. Chem. Russ., 1938, **11**, 597—598).—Comments on a paper by Lutschinski (A., 1937, I, 295). J. J. B.

Physico-chemical investigation of the system $POCl_3$–SO_2Cl_2. III. Density, viscosity, and b.p. G. P. Lutschinski and A. I. Lichatscheva (J. Phys. Chem. Russ., 1938, **11**, 317—320; cf. A., 1937, I, 296).—d and η are measured between 15° and 35°. The b.p. and the composition of the co-existing phases are measured at the ordinary pressure. J. J. B.

Viscosity and density of aqueous solutions of mercuric chloride at 35°. S. Prasad, A. S. Chakravarti, and B. Prasad (J. Indian Chem. Soc., 1938, **15**, 301—304).—The d of 0·001534—0·2652M solutions of $HgCl_2$ at 35° is $0{\cdot}9941 + 0{\cdot}228c$ (c in mol. per l.). Viscosity of 0·001534—0·1M solutions is $\eta/\eta_0 = 1 + 0{\cdot}125c$, but at higher concn. increases more rapidly. The linear variation of η in dil. solution indicates its resemblance to a non-electrolyte, the coeff. of $\sqrt{c}$ in Jones and Dole's equation being zero. F. R. G.

Diffusion in a centrifugal field of force. II. W. J. Archibald (Physical Rev., 1938, [ii], **54**, 371—374; cf. A., 1938, I, 352).—The general equation for the settling of particles and mols. in a liquid suspension or ideal solution is solved for the case of a cell with radial sides and two bounding cylindrical ends. A set of curves showing the concn. at all points in the cell for different vals. of the time is given. N. M. B.

Diffusion in non-ideal media.—See A., 1938, III, 948.

Apparent molecular volumes and hydration of acids and bases. A. I. Kasmin (J. Phys. Chem. Russ., 1938, **11**, 585—596).—The degree of hydration is calc. from the vol. contraction associated with mixing H_2O with strong acids or alkalis. J. J. B.

Fluorescence, absorption spectra, and electrical conductivity of fluorescein, rhodamine, and acriflavin in aqueous solution. I. C. Ghosh and S. B. Sengupta (Z. physikal. Chem., 1938, **B**, **41**, 117—141).—The dependence on concn. of the absorption spectra of solutions of K fluorescein and of the chlorides of rhodamine B and acriflavin, and the dependence of the fluorescence of these compounds on cell thickness, λ of incident light, and concn., have been investigated. Fluorescence is independent of the concn. at large dilutions, but in more conc. solutions it ceases on account of the formation of larger micelles which do not fluoresce. This behaviour corresponds with a fall in equiv. conductivity at high concns. C. R. H.

Optical behaviour of dissolved ions and its significance in the structure of electrolytic solutions. VII. Extinction of fluorescence and solvation. G. Kortüm (Z. physikal. Chem., 1938, **B**, **40**, 431—438).—Measurements have been made on the extinction of fluorescence of eosin anions in very dil. aq. solution by different inorg. and org. compounds. The results confirm those obtained from optical measurements in electrolytic solutions (A., 1938, 1, 23). W. R. A.

Refractometric investigation of the system sodium molybdate and mannitol in aqueous solution. G. Spacu and E. Popper (Z. physikal. Chem., 1938, **B**, **41**, 112—116).—The n at 22° of solutions of Na_2MoO_4 and of mannitol and of various mixtures of equimol. solutions of the two are recorded. The data for the mixtures indicate the existence of $Na_2[MoO_4(C_6H_{14}O_6)_2]$. C. R. H.

Titanium–tartaric acid complexes. V. Cagliotti (Congr. int. Quim. pura apl., 1934, **9**, IV, 537—547; Chem. Zentr., 1936, ii, 3532).—The change in [α] of aq. tartaric acid with $Ti(OH)_4$ indicates a complex, acid : Ti = 3 : 2, of which the dissociation is > that of the acid alone. The max. [α] varies with $TiCl_4$ (1 : 1, 2 : 1) and $Ti(SO_4)_2$ (5 : 1) according to the concn., an effect ascribed to free acid; *e.g.*, [α] of the $Ti(OH)_4$ complex is decreased 47%, that of tartaric acid only 5%, by HCl. A. H. C.

Valency and covalency of ruthenium in the blue chloride solution. L. W. N. Godward and W. Wardlaw (J.C.S., 1938, 1422—1424).—By the interaction of the blue solution resulting from the reduction of $RuCl_3$ solution with certain amines the following *compounds* have been isolated: $(C_5H_6N)_2RuCl_4$, $(NMe_3H)_2HRuCl_5$, $dipyH_2RuCl_4$, and enH_2RuCl_4. The metal is bivalent in these compounds, which have zero magnetic moment, as expected theoretically. O. J. W.

Interaction of atoms in alloys. W. Shockley (J. Chem. Physics, 1938, **6**, 523—525; cf. A., 1938, I, 305).—Extension to the interactions between atoms which are not nearest neighbours in the lattice does not bring Bethe's theory of superlattices (A., 1935, 1193) into better agreement with experiment, as it predicts, contrary to experiment, that many properties of binary alloys are symmetrical between the two constituents. The theory also disagrees with certain fundamental features of the interactions of atoms in alloys. W. R. A.

Dependence of diffusion velocity in metals on the crystallographic orientation (anisotropic diffusion). V. Bugakov and N. Breshneva (Tech. Phys. U.S.S.R., 1935, **2**, 435—443).—Hg diffuses into single crystals of Cd and Zn at rates depending on the direction of diffusion. The rate is highest for directions parallel and lowest for directions perpendicular to the base plane of the crystal. With rise in temp. the influence of direction becomes less marked. Similar results have been obtained for the diffusion of Cu into Zn. C. R. H.

Atomic vibrations of a zinc–copper alloy. M. L. FULLER (Physical Rev., 1938, [ii], **54**, 388—389).—The change in crystal lattice dimensions accompanying variation of composition of the ϵ and η phases in Cu–Zn alloys is in experimental analogy with the variation of at. vibrations with axial ratio as reported by Howard (cf. A., 1938, I, 448). N. M. B.

***X*-Ray study of silver–zinc alloys rich in silver above the β-transformation temperature.** E. A. OWEN and I. G. EDMUNDS (J. Inst. Metals, 1938, **62**, Advance copy, 163—176).—The various phase boundaries in alloys with 50—80% Ag have been determined by *X*-ray examination of alloys annealed for several days at the appropriate temp. and then quenched. The α–$(\alpha+\beta)$ boundary joins the points 76·8% Ag, 710° and 71·2% Ag, 270°, the $(\alpha+\beta)$–β boundary the points 71·2% Ag, 710° and 65·9% Ag, 270°, the β–$(\beta+\gamma)$ boundary the points 61·6% Ag, 667° and 61·4% Ag, 289°, and the $(\beta+\gamma)$–γ boundary the points 53% Ag, 667° and 51·4% Ag, 289°. A. R. P.

Alloys of magnesium with gallium, indium, and thallium. W. HAUCKE (Naturwiss., 1938, **26**, 577—578).—The intermediate phases occurring in the Mg–Ga, Mg–In, and Mg–Tl systems have been examined by *X*-ray methods. In the Mg–Ga system there are at least four intermediate phases. Mg_5Ga_2 crystallises in the rhombic space-centred system (*a* 13·72, *b* 7·0, *c* 6·02 A.; 28 atoms in unit cell). Mg_2Ga has a hexagonal structure (*a* 7·85, *c* 6·94 A.; 18 atoms in unit cell). MgGa and a phase with higher [Ga] show complex Debye–Scherrer diagrams. Four intermediate phases were found in the Mg–In system. Mg_5In_2 and Mg_2In have the same structures as Mg_5Ga_2 and Mg_2Ga, respectively. MgIn crystallises in the tetragonal space-centred system (*a* 3·24, *c* 4·35 A.; 2 atoms in unit cell). $MgIn_3$ is cubic. In the Mg–Tl system the existence of the three phases Mg_5Tl_2, Mg_2Tl, and MgTl was confirmed. Mg_5Tl_2 and Mg_2Tl have structures similar to those of Mg_5Ga_2 and Mg_2Ga, respectively. A. J. M.

Constitution of the magnesium-rich alloys in the systems aluminium–magnesium, gallium–magnesium, indium–magnesium, and thallium–magnesium. W. HUME-ROTHERY and G. V. RAYNOR (J. Inst. Metals, 1938, **63**, Advance copy, 203—228).—The Al–Mg eutectic lies at 437·2°, 30 at.-% Al, the solubility of Al in Mg is 11·5—11·6 at.-% at the eutectic temp., and the solidus is almost linear down to the eutectic horizontal. Mg and Ga form a eutectic at 422·7°, 19·1 at.-% Ga and 3·14 at.-% Ga is sol. in Mg at this temp. but <0·2 at.-% at 20°. Mg dissolves 19·4 at.-% In between the peritectic temp. (483·8°) and 327°; the solubility then decreases rapidly to about 14 at.-% at 200°. The solubility of Tl in Mg is 15·4 at.-% at 405° and decreases almost linearly to 7·3 at.-% at 200°; the eutectic is at 405·3°, 25 at.-% Tl. A. R. P.

Factors affecting the liquidus, solidus, and solid solubility curves in some alloys of magnesium. W. HUME-ROTHERY and G. V. RAYNOR (J. Inst. Metals, 1938, **63**, Advance copy, 229—245).—Theoretical. The general principles underlying the solubility relations in alloys of Al, Ga, In, and Tl with Mg are discussed and the differences between Mg and Zn and Cd as solute metals are shown to be satisfactorily accounted for by modern electronic theories. The high solubilities of In and Tl, the low solubility of Ga, and the strong temp.-dependence of the solubility of Al in Mg are readily explained by the size-factor theory. A. R. P.

Physico-chemical properties of cadmium–tin alloys. V. P. SCHISCHOKIN, A. S. ANDREEV, and F. F. BUKIN (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 65—99).—Hardness and conductivity data are recorded for the alloys at 20—190°. The solid solutions are of monat. Cd in Sn. R. T.

System aluminium–magnesium. F. LAVES and K. MOELLER (Z. Metallk., 1938, **30**, 232—235).—*X*-Ray examination shows that there are four intermediate phases: δ′, δ, γ, and β. The δ-phases (49—57% Mg) has an α-Mn structure, the δ′-phase (46% Mg) a distorted α-Mn structure, and decomposes below 300° into $\beta+\gamma$. The β- and γ-phases have complex structures giving numerous lines in the *X*-ray diagrams; the structure of β resembles that of Cu_4Cd_3. On heating above 390° γ decomposes into $\beta+\delta'$. A. R. P.

Ageing of Al–$MgZn_2$ alloys. P. L. SALDAU and M. I. ZAMOTORIN (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 27—36).—Ageing is most marked in alloys containing 6—14% of $MgZn_2$, and proceeds almost to completion in 120 hr. at 15° or in 20 hr. at 100°. R. T.

Constitution of lead-rich alloys of lead and cadmium. E. C. ROLLASON and V. B. HYSEL (J. Inst. Metals, 1938, **63**, Advance copy, 187—196).—The system up to 20% Cd was examined by thermal, micrographic, and resistivity methods. The eutectic is placed at 17·5% Cd, 248°; the solubility of Cd in Pb is 3·3% at this temp., 0·8% at 150°, and 0·3% at 20°. Thermodynamic analysis of the Pb end of the system indicates that both the liquid and solid solutions consist of monat. mols. of Cd in monat. mols. of Pb; the molal heat of fusion of Pb is calc. as 5·80 g.-cal. per g. A. R. P.

Atomic increase in the resistance of dilute lead alloys between 273° and 14° K. A. EUCKEN and H. SCHÜRENBERG (Ann. Physik, 1938, [v], **33**, 1—20).—Measurements have been made of the increase in the resistance of Pb by the presence of Mg, Ag, Cd, In, Sn, Sb, Hg, Tl, and Bi in solid solution. The at. increase ξ (= increase due to addition of 1 at.-%) is the greater the greater is the separation in the periodic system between the dissolved metal and Pb (cf. Norbury, Trans. Faraday Soc., 1921, **16**, 570). ξ is approx. $\propto \log D_x/D_{Pb}$, where D_x is the diffusion coeff. of the metal in Pb and D_{Pb} is the self-diffusion coeff. of Pb. At low temp. deviations from Mathiessen's rule were observed which increased with increasing ξ. Upper limits for the solubilities of Cd, Sb, and Mg in Pb at room temp., 0·65, 0·13, and 0·5 at.-%, respectively, were observed. O. D. S.

Manganese–copper alloys. N. I. KORENEV (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 47—63).—Workable alloys containing 48—75% Mn are obtained by reheating at 750—800°, or containing 75—95% Mn

at 800—1100°. At 800° the limit of solubility is 49·27% Mn. The mechanical properties of the alloys are adversely affected by presence of Al, Fe, or Si. An abrupt change in conductivity is found as the Mn content exceeds 50%. R. T.

Anomalous change in the electric resistance of iron–silicon alloys with a longitudinal magnetic field at various temperatures. Y. SHIRAKAWA (Nature, 1938, **142**, 395).—Data for Fe–Si alloys (1·66 and 9·43% Si) from −195° to 820° are tabulated. Resistance decreases with the longitudinal magnetic field at temp. other than those in the neighbourhood of the Curie point. L. S. T.

***X*-Ray investigation of heat-treated magnetic iron–nickel–aluminium alloys.** L. VERESTSCHJAGIN and G. KURDJUMOV (Tech. Phys. U.S.S.R., 1935, 2, 431—434).—The alloys have a regular at. arrangement in a cubic body-centred lattice. Reactions in solid solution, which take place before the separation of the γ-phase, govern coercivity changes. C. R. H.

Nickel–aluminium compound. A hardener for steel. F. B. FOLEY (Metal Progr., 1936, **29**, 53—56).—A Ni–Al compound (composition not given) is sol. in austenite but not in α-Fe. After a transformation has occurred in α-Fe the Ni–Al compound is pptd. Max. pptn.-hardness is obtained at 565°. CH. ABS. (*e*)

γ to α transformation in iron alloyed with palladium. R. HULTGREN and C. A. ZAPFFE (Nature, 1938, **142**, 395—396).—*X*-Ray examination of the Fe–Pd system reveals an intermediate stage in the decomp. of the γ-form which resembles martensite in several respects. Under quenching conditions, the decomp. of the γ-phase occurs in at least two steps, (i) the atoms rearrange themselves into a body-centred form, and (ii) Pd is pptd. out in a face-centred Pd-rich phase. L. S. T.

Micro-structure and hardness of iridium–bismuth alloys. Certain processes taking place during melting. P. S. BELONOGOV (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 37—46).—Ir–Bi alloys are formed by heating the metals for 4—6 hr. at 1450°. The compounds IrBi, m.p. 1420°, and Ir_2Bi, m.p. 1440°, and their solid solutions with Ir, are described. Alloys containing >5% Ir are highly resistant to the action of strong acids (HNO_3, HCl, aqua regia) at high temp. R. T.

Stability of silica hydrates of definite composition. R. SPYCHALSKI (Z. anorg. Chem., 1938, **239**, 317—320).—The hydrates of SiO_2 (A., 1930, 720) have been isolated by controlled isothermal dehydration, and are quite stable. Their solubilities in H_2O at 18—22° range from approx. 3×10^{-4} mols. per l. for $SiO_2,2{\cdot}5H_2O$ to approx. 2×10^{-3} mols. per l. for $SiO_2,0{\cdot}5H_2O$. F. J. G.

Solubility of quartz or flint after the action of water or soda solutions under pressure. J. A. HEDVALL and O. WEILER (Z. anorg. Chem., 1938, **293**, 295—300).—The % of "sol. SiO_2" formed when finely-divided quartz or flint is heated in an autoclave with aq. Na_2CO_3 increases with temp., $[Na_2CO_3]$, and with the degree of subdivision. The attack by H_2O is very slight but is appreciable after several hr. with very finely-divided material at 188°. F. J. G.

Solubility properties of series of salts with common anion. W. D. TREADWELL and A. AMMANN (Helv. Chim. Acta, 1938, **21**, 1249—1265).—Solubility relations in various groups of salts are compared and discussed with reference to the ionic radii, lattice energies, and the normal potential of the cations. J. W. S.

Solubility of bone salt.—See A., 1938, III, 920.

Quantitative investigations of amino-acids and peptides. IV. Solubilities of the amino-acids in water–ethyl alcohol mixtures. M. S. DUNN and F. J. ROSS (J. Biol. Chem., 1938, 309—332; cf. A., 1934, 139).—The solubilities of *dl*-alanine, *dl*-aspartic acid, *d*-glutamic acid (I), glycine, *dl*-leucine, *dl*-norleucine, *dl*-serine, and *dl*-valine (II) in 25%, 50%, 75%, and 95% aq. EtOH have been determined at 0°, 25°, 45°, and 65°. The solubilities in pure EtOH have also been measured for (I) at 25° and 40° and for (II) at 0°. The results are correlated with previous data and abnormal variations of solubility with temp. and [EtOH] are discussed with reference to the probable activity coeff. of the solutes. J. W. S.

Thin layers of tin and other metals. V. Corrosion of tin by dilute organic acids. J. A. N. B. K. VAN HEYNINGEN and D. A. WAS (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 717—724; cf. B., 1938, 393).—Corrosion of Sn by aq. citric acid (5×10^{-5} to 0·1M), lactic acid (5×10^{-4} to 0·1M), $EtCO_2H$ (0·1M), and BzOH (0·1M) has been studied by the optical method. The corrosion velocity decreases with time until a stationary state is reached. It is concluded that intermediate products are formed on the metal surface, and that these dissolve into the liquid with formation of complex ions. J. W. S.

Adsorption of gases from the lowest to the highest pressures. A. VON ANTROPOFF and L. SCHAEBEN (Z. Elektrochem., 1938, **44**, 586—587).—The equation for relative adsorption previously derived (cf. A., 1936, 1063) is presented in a more convenient form. C. R. H.

Theoretical and practical investigation of the adsorption velocity of gases on porous substances. E. WICKE (Z. Elektrochem., 1938, **44**, 587—590).—An equation for the adsorption and desorption velocity is derived and successfully applied to data for the adsorption of CO_2 on and its desorption from medicinal charcoal and SiO_2 gel. The theory assumes that the adsorbent consists of spheroidal aggregates, and it is emphasised that since SiO_2 gel has a different structure from C, the formula in this case can only be approx. C. R. H.

Relative effect of inhibitants on adsorption and on catalytic activity. I. E. B. MAXTED and C. H. MOON (J.C.S., 1938, 1228—1233).—Measurements of the effect of poisoning by H_2S on the adsorption of H_2 by Pt at 18° show a general parallel with the effect of increasing amounts of H_2S on the catalytic activity of the Pt for the hydrogenation of crotonic acid at 40°. A better correlation results if the fall in the velocity of adsorption due to the action of H_2S,

rather than the total adsorption, is compared. At a H_2 pressure of 0·06 mm. the rate of adsorption is not greatly changed by the poison, although the latter may have reduced the catalytic activity to 20% of its initial val. The velocity of adsorption is controlled in this case by the H_2 pressure. H. J. E.

Adsorption of deuterium on some promoted molybdenum oxides. J. H. HUDSON and G. OGDEN (Nature, 1938, **142**, 476—477).—Pronounced van der Waals adsorption occurs at 77° K. on surfaces of Zn–, Ni–, and Co–Mo oxides, D_2 being adsorbed more than H_2. The low-temp. heats of adsorption for D_2 are ~600 g.-cal. < those for H_2 in each case. At 218° (region of activated adsorption) the rate of adsorption of D_2 is < that of H_2 for all three adsorbents. With the Zn– and Co–Mo oxides, the adsorption of D_2 is < that of H_2 at <300°, and > that of H_2 at >300°. With the Ni–Mo oxide, the activated adsorption of D_2 never exceeded that of H_2. On Zn–, Co–, and Ni–Mo oxides, the high-temp. heats of adsorption for H_2 are 21,400, 31,400, and 21,600 g.-cal., respectively, and for D_2, 30,100, 34,200, and 31,125 g.-cal., respectively. Differences in activation energy also occur. L. S. T.

Gas absorption of thin metallic layers; explanation of the anomaly of the optical constants. M. KINDINGER and K. KOLLER (Z. Physik, 1938, **110**, 237—250).—Calculations based on the dispersion equation are in agreement with the observed relation between optical consts. and thickness and age of the layer. Large quantities of gas are absorbed which increase the no. of free electrons in the metal. The influence of gas absorption is greatest at long λλ and moderate layer thicknesses (5—30 mμ.) and least in the ultra-violet and for very thick or very thin films of metal. Measurement of the air equiv. of Au layers for α-rays leads to the no. of absorbed gas atoms and measurements on the transparency for light (λ = 436 mμ.) are in agreement with theoretical vals. calc. from optical consts. of massive Au. L. G. G.

Orientation of molecules in the surface layer of an adsorbent and gas adsorption. II. B. A. TALMUD and D. L. TALMUD (J. Phys. Chem. Russ., 1938, **11**, 345—351).—Palmitic acid (I) prepared by coagulation of its emulsions adsorbs ~0·6 mol. of NH_3 per mol.; when prepared by a continuous skimming off of its unimol. films or by pptn. of a 2% solution of NH_4 palmitate by 0·1N-HCl, it takes up 1—1·3 mol. of NH_3. Accumulated monolayers of a mixture of 33% of (I) and 67% of paraffin wax take up 20 mols. of NH_3. Almost the whole amount adsorbed is given off on evacuating. After desorption the adsorptive capacity is strongly lowered. NMe_3 is adsorbed like NH_3. J. J. B.

Adsorption of oxygen at the surface of molten silver. A GERASSIMOFF (Z. Elektrochem., 1938, **44**, 709—716).—O is adsorbed in at. form and the heat of adsorption, 5·2 kg.-cal., agrees fairly well with the heat of formation of Ag_2O. C. R. H.

Sorption of oxygen by several metal chromites. J. C. W. FRAZER and L. HEARD (J. Physical Chem., 1938, **42**, 855—862; cf. A., 1936, 283).—The temp. at which $CuCr_2O_4$, $ZnCr_2O_4$, $CoCr_2O_4$, $NiCr_2O_4$, and $BeCr_2O_4$ catalysts begin to cause conversion of CO into CO_2, and the temp. at which this conversion is complete, have been determined. The sorption of O_2 by the catalysts has been studied as a function of time and temp. over these temp. ranges, and the heats of activation of the processes are calc. With $BeCr_2O_4$ consistent results were not obtained, as alternate oxidation and reduction tended to increase the sorption; the same treatment lowered the temp. at which oxidation of CO began, but raised the temp. at which complete conversion occurred. J. W. S.

Physical and chemical phenomena during the contact of gases with noble-metal surfaces and especially with thin layers. M. AUWÄRTER and K. RUTHARDT (Z. Elektrochem., 1938, **44**, 579—585).—Variations with temp. in the electrical conductivity, κ, of thin layers of Pt, Pd, Rh, and Ir, on which gas is adsorbed, have been investigated. κ decreases slightly with rise in temp. until a temp. is attained characteristic of each gas, when κ suddenly and rapidly decreases. This change is attributed to the formation, on the metal surface, of a compound of metal and gas which, by preventing further interaction, is of the nature of a passive layer. C. R. H.

Carbonising conditions and carbon reactivity. See B., 1938, 1117.

Formation and properties of activated carbon. —See B., 1938, 1117.

Lubricating effect of adsorption layers. II. N. I. KOLESNIKOVA (J. Phys. Chem. Russ., 1938, **11**, 321—324; cf. A., 1935, 697).—The static friction between metal spheres and plates was measured. The surfaces were lubricated by a hydrocarbon oil with additions of stearic acid (I). For the couple steel–Al the friction does not depend on the concn. of the (I). For other metals it shows a min. at approx. 0·1—0·2% of (I). The dynamic friction at high velocities is not affected by addition of fatty acids. J. J. B.

Detection of adsorption of colloidal graphite in oil sols by metal surfaces. F. PAVELKA and A. WISCHIN (Kolloid-Z., 1938, **84**, 334—339).—Surface tension tests show that the adsorption of graphite by an Fe surface is much less in oil sols than in hydrosols and occurs relatively slowly. Adsorption is increased greatly by diluting the oil with petroleum (1 : 1). The controlling factors are probably the high viscosity of the oil and the high degree of solvation of the graphite particles. E. S. H.

Ion concentration and ion exchange at the boundary protoplasm–solution.—See A., 1938, III, 948.

Optical sensitisation of silver salts. III. Adsorption of pigments by silver bromide. A. I. RABINOVITSCH and S. V. NATANSON (J. Phys. Chem. Russ., 1938, **11**, 434—450; cf. A., 1936, 1215).—The adsorption by AgBr of Bismarck-brown, methylene-blue, malachite-green, and phenosafranine, which desensitise AgBr, is normal, whilst the adsorption isotherms of the sensitisers pyronine G, phloxine, eosin, and erythrosin show a plateau at medium concns.

Diffusion measurements show that the dyes used are molecularly dissolved, so that the abnormal adsorption cannot be due to micelles. The adsorption equilibrium is reached within a few min. The amount adsorbed is independent of temp. between 0° and 40°. J. J. B.

Influence of adsorbed layers on the rate of evaporation of water. N. I. Glasov (J. Phys. Chem. Russ., 1938, **11**, 484—491).—Evaporation of H_2O from flat dishes in an air current is reduced by surface films as follows: $C_{16}H_{33}\cdot OH > C_8H_{17}\cdot OH > C_{15}H_{31}\cdot CO_2H$ and $C_{25}H_{51}\cdot CO_2H >$ saponin. Only liquid films are effective. They reduce the convection under the surface. J. J. B.

Monolayers of isomeric unsaturated compounds. J. Marsden and E. K. Rideal (J.C.S., 1938, 1163—1171).—Measurements of the force-area characteristics made in a Langmuir trough with monolayers of oleyl alcohol, and oleic, petroselic, and erucic acids, and their respective *trans*-isomerides, are recorded. The *trans*-structures can form close-packed films by interlocking, this being impossible with the bent *cis*-forms. In mixed films the *trans*-unsaturated chains can pack with saturated chains, but the *cis*-forms cause expansion. In support of these observations, the oxidation rate of films of the *trans*-isomerides by 0·005% $KMnO_4$ + 0·01N-H_2SO_4 is shown to be very susceptible to compression. The *cis*-$(OH)_2$-acid is formed almost exclusively on oxidation at interfaces. The *trans*-$(OH)_2$-acids form solid films, an effect which suggests that there is H bonding between adjacent mols. H. J. E.

Protein monolayers. Films of oxidised cytochrome-*C*.—See A., 1938, III, 949.

Linear phenomena. IV. Linear adsorption by two-dimensional colloids. P. F. Pochil, T. I. Zilberman, and D. L. Talmud (J. Phys. Chem. Russ., 1938, **11**, 519—525).—The spreading pressure of a dil. two-dimensional solution of myristic acid on aq. $BaCl_2$ gradually decreases owing to formation of two-dimensional colloid particles of Ba myristate. The pressure of a mixture of this colloid with a gaseous film of $([CH_2]_7\cdot CO_2Me)_2$ is < the sum of the single pressures, indicating adsorption of the ester by the colloid. An average particle of the colloid contains 1000 mols. J. J. B.

Constitution of higher polymerides and structure of thin films. G. Natta (Congr. int. Quim. pura apl., 1934, 9, IV, 208—214; Chem. Zentr., 1936, ii, 3283).—Electron diffraction methods reveal uni- or bi-mol. films of fatty material on polyvinyl acetate preps. (cf. A., 1935, 687). A. H. C.

Labile organic molecules and interfacial phenomena. G. Semerano (Z. Elektrochem., 1938, **44**, 598—602).—A survey of recent work on the reactivity of the unstable acids $CH\cdot CO_2H$, $CH_2\cdot CO_2H$, etc., which are formed at Hg–H_2O and C–H_2O interfaces by the depolymerisation of certain acids, *e.g.*, fumaric, maleic, succinic. C. R. H.

Spreading of electrolyte solutions on filter-paper. II. K. Prosad and B. N. Ghosh (Kolloid-Z., 1938, **84**, 275—283; cf. A., 1937, I, 301).—Tests on the spreading of aq. H_2SO_4, HCl, and H_3PO_4 on filter-paper coloured with Me-orange show that two diffusion rings (corresponding with H_2O and acid, respectively) are formed with dil. solutions, but only one ring with conc. solutions. The amount of acid adsorbed by filter-paper in the inner ring has been determined; with HCl and H_3PO_4 the amount increases with increasing concn., but with H_2SO_4 the adsorption is independent of concn. The velocities of spreading of the above acids and of aq. NaCl and Na_2SO_4 have been measured and are discussed particularly in relation to adsorption. E. S. H.

Structure of surface films of oxides. I. Inactivation of pyrophoric iron aërosols by surface films of oxides. A. Winkel and R. Haul (Z. Elektrochem., 1938, **44**, 611—619).—*X*-Ray and electron diffraction analysis show that inactivation is brought about by a film of Fe_3O_4 approx. 10 A. thick. The data are discussed with reference to other methods of inactivation. C. R. H.

Constant characterising volatile materials in very dilute solution. S. Wehrli (Helv. Chim. Acta, 1938, **21**, 1384—1391).—When aq. solutions of alcohols (≯0·3%) are distilled in an inverted flask with the vapour outlet pointing vertically downwards the alcohol content of the distillate at any instant is given by $-dx = dv.kx/(Q - v)$, where Q is the total amount of initial material, v the amount already distilled, x the amount of alcohol in the residual liquid, and k is a const. The val. of k increases regularly with increasing no. of C atoms in the alcohol mol. J. W. S.

Historical root of colloid science. Wo. Ostwald (Kolloid-Z., 1938, **84**, 258—265).—A lecture. E. S. H.

Smokeless zone around heated platinum ribbon. S. Miyake (Rep. Aeronaut. Inst. Tokyo Univ., 1935, No. 123, 85—106).—The breadth (B) of the smokeless zone around an electrically heated vertical Pt ribbon is given by $B = C\theta a/p$, where θ is the temp. difference between the wire and the ambient air, p is the gas pressure, and C and a are consts. For stable smokes (*e.g.*, TiO_2, P_2O_5) the val. of B is approx. independent of the smoke. Larger vals. were obtained for H_2SO_4 and NaCl smokes, due to evaporation of the particles. The val. of B is unaffected by radiation from the hot body, or by electric or magnetic fields. The smokeless zone arises from air convection and the Magnus effect. Ch. Abs. (*e*)

Determination of average particle size of a colloidal solution of a metal by measuring the absorption of light for two monochromatic wavelengths. M. F. Kazanski (J. Phys. Chem. Russ., 1938, **11**, 546—554).—The particle size calc. according to Mie's theory from measurements made with a Ag sol agrees with that found by direct counting. J. J. B.

Light-scattering in solutions of large molecules. W. Lotmar (Helv. Chim. Acta, 1938, **21**, 953—984; cf. A., 1938, I, 397).—An improved form of apparatus for determination of the degree of depolarisation of scattered light is described. Measurements are recorded for a no. of colloidal

solutions and are compared with corresponding data for solutions of smaller mols. J. W. S.

Theory of ultra-filtration of colloidal solutions. M. TEMKIN (J. Phys. Chem. Russ., 1938, **11**, 296—299).—A Donnan equilibrium between sol and ultra-filtrate is assumed (cf. A., 1936, 1461), and the concn. of both calc. for different stages of the ultra-filtration. J. J. B.

Colour and nature of solutions of sodium in liquid ammonia. F. KRÜGER (Ann. Physik, 1938, [v], **33**, 265—284).—Vals. of the absorption coeff. of solutions of Na in liquid NH_3 calc. by the theory of Mie for colloidal solutions are in approx. agreement with those measured by Gibson and Argo (A., 1918, ii, 417). Ultramicroscopic and filtration experiments support the conclusion that the solutions are colloidal. The lifetime of the solutions can be increased by the addition of protective colloids. O. D. S.

Ferromagnetic colloid for studying magnetic structures. W. C. ELMORE (Physical Rev., 1938, [ii], **54**, 309—310).—The prep. and advantages of a colloidal magnetite are described. N. M. B.

Peptisation of aluminium hydroxide by ammonia in presence of boric acid. F. PAVĚLKA (Kolloid-Z., 1938, **84**, 303—311).—H_3BO_3 is adsorbed by the ppt. in accordance with the Freundlich equation. Peptisation, which under certain conditions is reversible, occurs at a definite temp. which depends on the H_3BO_3 : $Al(OH)_3$ ratio; this effect is reduced by mannitol, but not by MeOH, $(CH_2{\cdot}OH)_2$, or glycerol. The ppt. is considered to have a foam structure. E. S. H.

Structure of iron hydroxide sols. V. A. KARGIN and V. V. KISELEVA (J. Phys. Chem. Russ., 1938, **11**, 461—466).—Absorption spectra of $Fe(OH)_3$ sols are almost unaffected by addition of $K_4Fe(CN)_6$ or KCNS; consequently the sols do not contain $Fe^{...}$. It is concluded that they are stabilised by HCl. J. J. B.

Exchange adsorption of ions by colloidal iron oxide. V. A. KARGIN and G. V. KLIMOVITZKAJA (J. Phys. Chem. Russ., 1938, **11**, 467—472).—The amounts of SO_4'' adsorbed and of Cl' liberated during the coagulation of $Fe(OH)_3$ sol by Na_2SO_4 and by H_2SO_4–Na_2SO_4 and Na_2SO_4–NaOH mixtures were measured. J. J. B.

Irregular series in mercuric sulphide sols. I. Winssinger's mercuric sulphide sol. N. SATA and Y. NIWASE (Kolloid-Z., 1938, **84**, 314—319).—The degree of peptisation of HgS ppts. by H_2S depends on the purity of HgS and on the relative amounts of solid phase and H_2S. Irregular series is exhibited in coagulation by $AgNO_3$ when the sol contains Cl'. E. S. H.

High-frequency conductivity of colloidal electrolytes. IV. Change from molecular disperse to colloid state in soap-like sols. G. SCHMID and E. C. LARSEN (Z. Elektrochem., 1938, **44**, 651—658; cf. A., 1938, I, 78).—The chemical and electrostatic theories of McBain and Lottermoser and of Hartley and Pauli, respectively, are discussed. High-frequency conductivity data for solutions of Na dodecyl sulphate, cetylpyridinium chloride, Na oleate, and Ca and K arabate support the electrostatic and contradict the chemical theory. C. R. H.

Comparative electrochemical investigations on highly purified lyophilic sols. VI. Electrochemistry of algic acid sol. W. PAULI and L. STERNBACH (Kolloid-Z., 1938, **84**, 291—303; cf. A., 1937, I, 410).—Electrochemical and viscosimetric measurements have been carried out on the acid and neutralised sols, purified by electrodialysis and electrodecantation. Evidence of the existence of a hydrated form, containing chains of $C_6H_{10}O_7$, is reported; the acid equiv., determined conductometrically, is 194. The influence of dilution on dissociation of the acid has been investigated. The neutralised sols have higher η than the acid sols. E. S. H.

Influence of electrolytes on the viscosity of cellulose nitrate. S. A. GLIKMAN (J. Phys. Chem. Russ., 1938, **11**, 512—518).—A review. J. J. B.

Complex systems of biocolloids. I. Survey and classification according to colloid-chemical and electrochemical points of view. II. Specific factors of importance to the intensity of the complex relations, and their significance in particular with regard to the formation of the tricomplex systems. H. G. B. DE JONG (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 776—787, 788—799).—I. Colloid systems in which complex relations occur, owing to simultaneous electrical attraction and repulsion as a result of solvatation, are surveyed. According as the complex relations exist between zwitterions or multipolar ions mutually, cations and anions, or simultaneously between zwitterions, cations, and anions these systems are classified as unicomplex, dicomplex, and tricomplex systems, respectively. The relationships of these classes with analogous crystalloid systems and their limit cases (NH_2-acid crystals, NaCl crystals, and crystals of the double compounds of NH_2-acids with NaCl) are discussed.

II. Factors determining the intensity of the complex relations between colloidal anions and colloidal cations are discussed. These relations become the stronger the lower is the equiv. wt. of the colloid. The effects of ionic characteristics on charge reversal in such systems (A., 1938, I, 457) are discussed. The theoretical deduction that tricomplex flocculation will occur between a small inorg. cation and a sulphate colloid of high surface charge is confirmed by the occurrence of such flocculation in systems containing isoelectric gelatin or egg-lecithin, with Na carragheen and $CaCl_2$ or LiCl. J. W. S.

Origin of ferromagnetic gels and allied phenomena. T. KATSURAI and K. YAMASAKI (Kolloid-Z., 1938, **84**, 311—314).—Ferromagnetic gels are obtained by grinding $Na_2SO_4,10H_2O$, $MgSO_4,7H_2O$, $MnSO_4,5H_2O$, $NiSO_4,7H_2O$, $CoSO_4,7H_2O$, $ZnSO_4,7H_2O$, $CuSO_4,5H_2O$, $CdSO_4,8/3H_2O$, $HgSO_4$, or $UO_2SO_4,3H_2O$ with $FeCl_3,6H_2O$ (mol. ratio 2 : 1). On heating in an autoclave at 180° the gels separate into a liquid and a solid phase; the solid phase is insol. in H_2O and does not resemble magnetite or hæmatite. Magnetic properties of magnetite ppts. formed by reaction in aq. solutions are described. The change of colour

occurring when aq. $Fe^{\cdot\cdot}$ and $Fe^{\cdot\cdot\cdot}$ salts are mixed has been measured photometrically and is discussed. E. S. H.

Thixotropic gelation of thorium molybdate gels. M. PRASAD, S. M. MEHTA, and (MISS) H. RATHNAMMA (J. Indian Chem. Soc., 1938, **15**, 365—376).—The η of Th molybdate gels, which are thixotropic, has been measured by Scarpa's method during gel formation from mixtures of $Th(NO_3)_4$, K_2MoO_4, and HCl. The η–time curves are not continuous but show well-marked changes of direction, a phenomenon not previously observed during gel formation. Increase in concn. of $Th(NO_3)_4$, K_2MoO_4, or HCl increases the first max. η. Addition of electrolytes and/or non-electrolytes does not alter the nature of the curves. The first max. becomes less and the rest of the curve smoother with rise of temp. F. H.

Gel formation in proteins. W. KOPACZEWSKI (Protoplasma, 1937, **29**, 180—193).—Gel formation can be induced in a no. of protein hydrosols by treatment with acids, bases (including org. bases), salts, or surface-active substances, such as bile salts. Both cations and anions are effective, and the effect of two or more substances is additive. In the case of bases the change can be reversed by heating, stirring, or dialysis. Standard anti-coagulants accelerate the action of acids, bases, or salts. Gel formation is not a chemical process, but a change in the equilibrium between different degrees of hydration. M. A. B.

Mechanism of deformation of fibrous substances. VI. Double refraction of Herman's cellulose hydrate gel. O. KRATKY and P. PLATZEK (Kolloid-Z., 1938, **84**, 268—275; cf. A., 1938, I, 515).—The double refraction and dimensional changes of fibres in H_2O, EtOH, and glycerol have been measured. The sp. double refraction is deduced and the results are discussed in relation to Wiener's theory. E. S. H.

Mechanism of coagulation of cellulose ester sols. S. A. GLIKMAN (J. Phys. Chem. Russ., 1938, **11**, 492—511).—If a solution of cellulose benzoate (I) in EtOH+C_6H_6 is pptd. by EtOH or light petroleum, or a solution of cellulose nitrate (II) in $COMe_2$ by H_2O or C_6H_{14}, the amount of coagulating liquid required increases with rise of temp. The similar behaviour of H_2O and C_5H_{14} etc. shows that the polarity of the coagulant is irrelevant. Addition of small amounts of EtOH to a solution of (I) in C_6H_6 causes a contraction, and that of large amounts an expansion, but the coagulation point is not observable. The η of (I) in C_6H_6 is reduced by EtOH; there is no change of η at the coagulation point. The η of (II) in $COMe_2$ is increased by light petroleum. The effect of Et_2O on the η of (II) in EtOH is complicated. Addition of H_2O causes expansion in solutions of (II) in $COMe_2$. J. J. B.

Influence of organic non-electrolytes on oleate and phosphatide coacervates. I. H. G. B. DE JONG and G. G. P. SAUBERT. **II. Influence of different alcohols.** H. G. B. DE JONG, H. L. BOOY, and G. G. P. SAUBERT (Protoplasma, 1937, **28**, 498—515, 543—561).—I. Hydrocarbons with b.p. above 150° decrease the vol. and increase the d of oleate coacervates as shown by changes observed under the microscope. The effect decreases with increasing b.p. The hydrocarbon mols. probably act as cohesion intermediaries between the hydrocarbon chains of the oleate ions as a result of a van der Waals attraction. On this assumption the effect should increase with increasing mol. size; the fact that the reverse occurs is attributed to decreasing H_2O-solubility.

II. The influence of *n*- and *iso*-alcohols varies with the length of the C chain. With the lower members a decrease in d of the coacervate occurs; with the higher members an increase. Probably the decrease in d is due to the OH group and depends on its hydrophilic properties, whilst the increase in d is due to the cohesive action of the hydrocarbon chain. The result produced by any given alcohol depends on which of these effects predominates. The nearer is the OH group to the middle of the mol. the greater is its effect. The effect of alcohols is, in general, greater on phosphatide than on oleate coacervates. With phosphatides the thickening produced by MeOH, EtOH, and PrOH shows a max. at the point of reversal of charge. M. A. B.

Solubility of casein in salts of certain organic acids and its fractionation by means of these acids. R. H. MCKEE and S. P. GOULD (J. Agric. Res., 1938, **57**, 125—143).—The solubility of acid-pptd. casein in aq. Na cymenesulphonate, $PhSO_3Na$, and KCNS of varying concns. is recorded. Vals. increase with temp. The sulphonate solutions at p_H 4·6 separate casein into at least two fractions differing in composition and properties, notably % P and capacity to absorb CH_2O. A. G. P.

Cataphoresis of a spherical particle. S. KOMAGATA (Res. Electrotech. Lab. Tokyo, 1935, No. 387, 35 pp.).—A general equation for cataphoresis of a spherical particle, taking into account deformation of the ionic atm., is derived. The deformation effect tends to decrease the cataphoretic velocity. CH. ABS. (*e*)

Determination of purity of cerebroside and sphingomyelin by a colloid-chemical method.—See A., 1938, III, 843.

Streaming potential and surface conductivity. A. J. RUTGERS, E. VERLENDE, and M. MOORKENS (Proc. K. Akad. Wetensch. Amsterdam, 1938, **41**, 763—775).—The abnormal variation of the electrokinetic potential with concn. observed for KCl solutions is attributed to surface conductivity effects. Formulæ permitting the separation and evaluation of each of these effects are derived, and confirmed by measurements on dil. aq. KCl and $BaCl_2$. J. W. S.

Diffusion of vapours of organic solvents across cellulose ester films. A. PAKSCHVER and E. MANKASCH (J. Phys. Chem. Russ., 1938, **11**, 400—409).—Diffusion of H_2O, $COMe_2$, EtOH, Et_2O, and $(CH_2Cl)_2$ vapours across films of cellulose nitrate, acetate, and benzoate was measured. The diffusion coeff. D rises with increasing thickness of the film, presumably owing to stationary air layers on both sides of the film. If the film does not swell in the vapour diffusing D remains const.; in the opposite case D mostly decreases in the course of an experiment. There is no obvious relation between D and the magnitude of the swelling, which was also measured.

The solvent from which the film was prepared is irrelevant. J. J. B.

Two aspects of the second law of thermodynamics in systems at a non-uniform temperature. R. Defay (Bull. Acad. roy. Belg., 1938, [v], **24**, 474—487, 534—544).—Mathematical. W. R. A.

Partial molar volumes [$\bar{v}$] of strong electrolytes at high pressures. I. R. Kritschevski (J. Phys. Chem. Russ., 1938, **11**, 305—309).—The thermodynamical equation $\bar{v} = \delta\bar{F}/\delta p$ is used, $\bar{F}$ being the partial molar free energy and p the pressure. $\bar{F}$ consists partly of the electrostatic energy of ions which depends on the dielectric const. (ϵ) of the solvent. Thus the equation $\bar{v} = a-(b/\epsilon^2)(\delta\epsilon/\delta p)$ is derived (a and b are consts.). This equation agrees with experiments of Adams (cf. A., 1932, 810) and Gibson (cf. A., 1937, I, 513). From the val. of b the mean radius of NaCl is calc. to be 0·9 A. J. J. B.

Exchange forces and electrostatic forces between ions in solution. R. W. Gurney (J. Chem. Physics, 1938, **6**, 499—505).—The mechanism of ionic dissociation of mols. in solution has been investigated by the methods of statistical mechanics. W. R. A.

Acids and bases. G. N. Lewis (J. Franklin Inst., 1938, **226**, 293—313).—A lecture.

Chemical constitution and the dissociation constants of monocarboxylic acids. X. Saturated aliphatic acids. J. F. J. Dippy (J.C.S., 1938, 1222—1227; cf. A., 1938, I, 250).—The thermodynamic dissociation consts. of n-acids ($PrCO_2H$—$C_8H_{17}\cdot CO_2H$) and of $Pr^{\beta}CO_2H$, $CHEt_2\cdot CO_2H$, $Bu^{\beta}CO_2H$, and $Bu^{\gamma}CO_2H$ have been determined. Vals. for the n-acids (excluding $PrCO_2H$) fall as the series is ascended. *sec.*-$BuCO_2H$, $CHEt_2\cdot CO_2H$, and $Bu^{\beta}CO_2H$ are comparable with $PrCO_2H$ in possessing abnormally high strengths. $PrCO_2H$ does not differ from $EtCO_2H$ in strength, despite the marked fall in $Bu^{\gamma}CO_2H$. This observation is related to the anomalous order found in the p-alkylbenzoic acids. H. J. E.

Electrostatic influence of substituents on the dissociation constants of organic acids. I. J. G. Kirkwood and F. H. Westheimer. **II.** F. H. Westheimer and J. G. Kirkwood (J. Chem. Physics, 1938, **6**, 506—512, 513—517).—I. Mathematical. An extension of Bjerrum's theory of the influence of substituents on dissociation consts. (A., 1923, i, 1059), treating the mols. and ions in which the charges are embedded as cavities of low dielectric const., leads to better results, especially for short-chain dicarboxylic acids. It also permits a satisfactory treatment of the influence of dipolar substituents on dissociation consts.

II. The theory is extended to acids ellipsoidal in shape. W. R. A.

Free energy of the producer-gas reaction, and the "zero-point" entropy of graphite. F. D. Rossini (J. Chem. Physics, 1938, **6**, 569).—Using new thermodynamical data for the reactions $C_{(graphite)} + O_{2(g)} = CO_{2(g)}$, $CO_{(g)} + \frac{1}{2}O_{2(g)} = CO_{2(g)}$, and $C_{(graphite)} + \frac{1}{2}O_{2(g)} = CO_{(g)}$, the following new thermodynamical vals. for the producer-gas reaction $C_{(graphite)} + CO_{2(g)} = 2CO_{(g)}$, (I), have been calc.: $\Delta H^0_{291\cdot16} = 41,240\pm58$ g.-cal., $\Delta G^0_{298\cdot16} = 28,663\pm59$ g.-cal., $\Delta H^0_0 = 39,587\pm58$ g.-cal. By combination of this val. of ΔH^0_0 with the appropriate vals. of $(G^0 - H^0_0)/T$, the equilibrium consts. of reaction (I) have been calc. at various temp. The vals. obtained agree with recorded experimental vals., and indicate the non-existence of a "zero-point" entropy for graphite. W. R. A.

Equilibrium between chlorine and bromine and metallic halide melts. H. Schütza (Z. anorg. Chem., 1938, **239**, 245—256; cf. A., 1936, 681).—The equilibria metallic bromide + $Cl_2 \rightleftharpoons$ chloride + Br_2 have been investigated for Pb at 500°, Na at 800°, Ag at 500° and 800°, and Cd at 600°. The equilibrium consts. (activities being introduced where necessary) agree with those found indirectly. The equilibrium const. for $2BrCl \rightleftharpoons Br_2 + Cl_2$ is 0·140 at 800°. F. J. G.

Double decomposition in absence of solvents. XXXIV. Reversible mutual system of potassium and lead chlorides and sulphates. XXXV. Singular irreversible mutual system, of a transitional nature, of silver and cadmium chlorides and sulphates. O. S. Dombrovskaja. **XXXVII. Irreversible mutual system of potassium and sodium nitrates and iodides.** F. I. Vasenin and A. G. Bergman. **XXXVIII. Irreversible mutual system of potassium and thallium chlorides and sulphates.** O. S. Dombrovskaja. **XXXIX. Irreversible mutual system of potassium and sodium chlorides and fluorides.** V. D. Poljakov. **XL. Density isotherms of the irreversible mutual system of sodium and potassium chlorides and fluorides.** E. N. Varasova, N. P. Lushnaja, E. I. Lukjanova, and A. G. Bergman. **XLI. Complex irreversible system of potassium, sodium, and magnesium sulphates and chlorides.** A. G. Bergman and N. M. Selivanova. **XLII. Irreversible mutual system of silver and thallium nitrates and sulphates.** P. T. Sokolov. **XLIII. Irreversible mutual system, of transitional type to singular systems, of sodium and potassium fluorides and iodides.** A. G. Bergman and F. P. Platonov. **XLIV. Complex mutual system of sodium, potassium, and thallium nitrates and chlorides.** R. N. Niankovskaja. **XLV. Irreversible mutual systems of sodium and potassium fluorides and sulphates.** S. Mukimov. **XLVI. Mutual system of sodium and potassium fluorides, chlorides, and iodides.** G. I. Nagornij (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 135—150, 151—167, 169—187, 189—199, 201—212, 213—224, 225—235, 237—251, 253—266, 267—274, 275—290, 291—325).—XXXIV. The fusion diagrams of the system $K_2SO_4 + PbCl_2 \rightleftharpoons PbSO_4 + 2KCl$, and of its constituent binary systems, are given. The compounds $KCl,PbCl_2$, $KCl,2PbCl_2$, $K_2SO_4,PbSO_4$, and $K_2SO_4,2PbSO_4$ are confirmed.

XXXV. The fusion diagrams of the system $Ag_2SO_4 + CdCl_2 \rightarrow CdSO_4 + 2AgCl$, and of the constituent binary systems, are given. Compounds are not formed.

XXXVII. The fusion diagrams of the system $KNO_3 + NaI \rightleftharpoons NaNO_3 + KI$ and of its constituent

systems are given. The compounds $NaNO_3$,NaI and KNO_3,KI are suggested.

XXXVIII. The fusion diagrams of the system $K_2SO_4 + 2TlCl \rightleftharpoons Tl_2SO_4 + 2KCl$, and of the constituent binary systems, are given. Compound formation is not observed.

XXXIX. The fusion diagrams of the system $NaF + KCl \rightleftharpoons KF + NaCl$, and of the constituent binary systems, are given. Compounds are not formed.

XL. The *d*-composition curves of the system $NaF + KCl \rightleftharpoons KF + NaCl$, at 650°, 700°, 750°, and 800°, are given.

XLI. The fusion diagram of the system NaCl–KCl–$MgSO_4$ is given.

XLII. The fusion diagrams of the systems $TlNO_3$–Tl_2SO_4, $AgNO_3$–Ag_2SO_4, and $2AgNO_3 + Tl_2SO_4 \rightarrow 2TlNO_3 + Ag_2SO_4$ are given.

XLIII. The fusion diagram of the system $NaI + KF \rightarrow NaF + KI$ is given.

XLIV. The fusion diagram of the system KNO_3–$NaNO_3$–TlCl is given.

XLV. The fusion diagram of the system $2KF + Na_2SO_4 \rightarrow K_2SO_4 + 2NaF$ is given. The compounds Na_2SO_4,NaF and K_2SO_4,KF are suggested.

XLVI. Fusion diagrams are given for the system $NaI + NaCl + KF \rightarrow KI + KCl + NaF$. R. T.

Equilibria in binary systems containing phenylenediamines. N. A. Pushin and M. Dezelic (Monatsh., 1938, **72**, 65—75).—The m.p. diagrams are recorded for 11 binary systems containing *o*-, *m*-, or *p*-$C_6H_4(NH_2)_2$ and BzOH, CHPh:CH·CO_2H, salol, thymol, and menthol. BzOH and CHPh:CH·CO_2H form equimol. *compounds* with all three isomerides, but only those with *p*-$C_6H_4(NH_2)_2$ have congruent m.p. There also exists *compounds* 2BzOH,*o*-$C_6H_4(NH_2)_2$ with congruent m.p. and 2BzOH,*m*-$C_6H_4(NH_2)_2$ and 2CHPh:CH·CO_2H,*o*-$C_6H_4(NH_2)_2$ with incongruent m.p. No compounds are produced in the binary systems of salol with *o*-, *m*-, and *p*-$C_6H_4(NH_2)_2$ or in the systems thymol–*o*-$C_6H_4(NH_2)_2$, menthol–*p*-$C_6H_4(NH_2)_2$, and *o*-$C_6H_4(NH_2)_2$–*p*-$C_6H_4(NH_2)_2$. J. W. S.

Relationship of beryllium to the vitriol-forming group and to the alkaline-earth metals. III. Double-sulphate formation between sodium and beryllium sulphates in comparison with the vitriols. II. [Polytherms of the ternary system $BeSO_4$–Na_2SO_4–H_2O between 0° and 100°.] W. Schröder [with H. Hompesch and P. Mirbach] (Z. anorg. Chem., 1938, **239**, 225—239; cf. A., 1938, I, 517).—The 75°, 86°, and 99·5° isothermals show the existence of a *Be-vanthoffite*, $BeSO_4,3Na_2SO_4$, which was not detected in the earlier experiments because although stable at lower temp. (>42°) it is not formed except in presence of nuclei. Corr. 50° and 60° isothermals are given. F. J. G.

Micro-disperse type of solid solutions in the system $NiCl_2$–NH_4Cl–H_2O. N. S. Kurnakov and V. S. Egorov (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 101—134).—The solid phases at 0°, 25°, and 50° are $NiCl_2$,2, 4, and $6H_2O$, $NiCl_2$,NH_4Cl,$6H_2O$, and micro-disperse crystals of $NiCl_2$,NH_4Cl,$2H_2O$ (I) in NH_4Cl, or of NH_4Cl in (I). R. T.

Methods for the graphical representation of quaternary systems involving reciprocal salt pairs, making possible the extrapolation of tie-lines. J. E. Ricci and C. M. Loucks (J. Chem. Educ., 1938, **15**, 329—333).—A new method in which the system is plotted in an irregular pyramid in terms of equivs. of the components per 100 g. of mixture is described and compared with a similar method due to Schreinemakers (cf. A., 1908, ii, 571, 935). Shortcomings of the usual methods are discussed. L. S. T.

Representation of diagrams of quinary aqueous mutual systems of six salts as projections of a four-dimensional pyramid. V. P. Radischtschev (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 5—25).—Geometrical methods are described. R. T.

Heat of formation of gaseous hydrogen bromide. W. A. Roth and E. Börger (Z. anorg. Chem., 1938, **239**, 327—328).—The reaction Ag + HBr (aq.) = $0·5H_2$ + AgBr occurs slowly at room temp. and is slightly exothermic. The heat of formation of gaseous HBr is therefore slightly <3·7 kg.-cal. per g.-mol. F. J. G.

Methods for determining heats of formation of oxides of strongly-reducing elements. W. A. Roth, E. Börger, and H. Siemonsen (Z. anorg. Chem., 1938, **239**, 321—326).—The sources of error inherent in various methods are discussed. In the direct method the use of Cellophane as auxiliary substance is advantageous. In this way the vals. for BeO and ZrO_2 are found to be 147·3 and 258·3 kg.-cal. per g.-mol., respectively, at 20°. F. J. G.

Heat of combustion of mono- and poly-styrene. W. von Luschinsky (Z. physikal. Chem., 1938, **182**, 384—388).—The heat of combustion of polystyrene (prepared by heating monostyrene at 180° for 6 hr.) is < that of styrene. The polystyrene produced can be separated into fractions with different heats of combustion. The results are discussed with reference to the energy changes involved in the polymerisation process. J. W. S.

Heat of dissolution of calcium and magnesium oxides and hydroxides. K. Taylor and L. S. Wells (J. Res. Nat. Bur. Stand., 1938, **21**, 133—149).—Data for the heat of dissolution ($-\Delta H_s$) of MgO in HCl show that the heat evolved decreases as the temp. at which the MgO is prepared is raised. This effect is shown by a decreasing rate of dissolution and by sedimentation experiments to be due to an increase of particle size with increasing ignition temp. No change of cryst. form occurs. The heat of hydration ($-\Delta H_h$) [MgO → $Mg(OH)_2$ (I)] is similarly dependent on the properties of the MgO and (I). Vals. of ΔH_s for (I), CaO, and $Ca(OH)_2$ in HCl, and measured and calc. vals. of ΔH_h for CaO, are recorded. A. J. E. W.

Isotope action in the heat of dilution of highly concentrated electrolyte solutions and of water–dioxan mixtures at 25°. W. Birnthaler and E. Lange (Z. Elektrochem., 1938, **44**, 679—693).—The heats of dilution of solutions of LiCl and LiBr in H_2O and D_2O have been determined, and the data

compared with similar data for other solutions and with other properties of LiCl and LiBr solutions. Similar data for H_2O–dioxan and D_2O–dioxan mixtures have also been obtained. The data are represented graphically and are discussed theoretically at length. C. R. H.

Coupling of ionic transference at multiple electrodes. K. NAGEL (Z. Elektrochem., 1938, **44**, 637—639).—Theoretical. C. R. H.

Direct measurement of the electrolytic migration velocity in metallic solutions. K. SCHWARZ (Z. Elektrochem., 1938, **44**, 648—651).—A glass capillary, filled with Hg, dips into a vessel containing Hg, and a Pt wire is fused into the closed top of the capillary. When a current is passed through the Hg, there is a rise in temp. in the capillary. If the Hg in the vessel is replaced by an amalgam, the dissolved metal will, under the influence of the current, migrate up the capillary. Since the conductivity of the amalgam will differ from that of the pure Hg, the temp. in the capillary where there is amalgam will differ from that part where there is still pure Hg. By means of a thermoelement the point in the capillary where there is a temp. change can be ascertained, and its rate of movement measured. C. R. H.

Adsorption potentials and ageing liquids. G. EHRENSVÄRD and L. G. SILLÉN (Nature, 1938, **142**, 396—397).—Mainly a reply to criticism (A., 1938, I, 451). Freshly-distilled org. liquids show a marked difference in e.m.f. from those which have been kept in a glass bottle. The ageing process, which may be due to mol. re-association, is soon completed. L. S. T.

Galvanic cells with formation of alloys. V. A. PLOTNIKOV and D. P. ZOSIMOVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 31—34; cf. A., 1934, 1178; 1935, 1080; B., 1936, 842; A., 1937, I, 189; 1938, I, 143; *et al.*).—A review, with special reference to the authors' published work. I. McA.

Kinetics of the electrode process at an ammonia gas electrode. A. S. FOMENKO (J. Phys. Chem. Russ., 1938, **11**, 578—584).—The potential change $\Delta\pi$ of platinised Pt in aq. NH_4NO_3 saturated with NH_3 is connected with the c.d. I of the polarising current by the equation $\Delta\pi = a - b \log I$, a and b being consts. Between 0° and 30° b rises from 0·034 to 0·039; its val. suggests that $NH_3 + 3OH' \rightarrow N + 3H_2O + 3\ominus$ is the slowest reaction at the electrode. J. J. B.

Mechanism of occurrence of potential drop on platinum in silver salt solutions. A. OBRUTSCHEVA (J. Phys. Chem. Russ., 1938, **11**, 473—483).—In $AgNO_3$ and Ag_2SO_4 solutions bright and platinised Pt electrodes assume the potentials of a Ag electrode since some Ag is deposited on Pt. This Ag originates from $Ag_2^{\cdot}$ ions. Their concn. may be estimated if the charge necessary to produce a definite shift of the Pt potentials is compared with the amount of $AgNO_3$ solution producing the same shift. 1N-$AgNO_3$ contains approx. 10^{-5}N-$Ag_2^{\cdot}$, and after heating with Ag up to 10^{-4}N. A simple adsorption of $Ag^{\cdot}$ on Pt does not affect its potential. J. J. B.

Polarographic studies with dropping mercury cathode. LXXIV. Electronegativity rule of the reduction potentials of organic compounds. M. SHIKATA and I. TACHI (Coll. Czech. Chem. Comm., 1938, **10**, 368—379).—Electrolytic reduction potentials recorded in the authors' earlier papers are summarised and it is shown that the reducibility of substituted aromatic ketones, azo- and NO_2-compounds increases with the electro-negativity of the substituents. F. R. G.

Electrolyte streaming at cathodes. I. Mercury and gallium dropping cathodes. H. J. ANTWEILER (Z. Elektrochem., 1938, **44**, 663).—Electrolyte streaming is due to the effect of a potential gradient, caused by reductions in c.d., on the electrical double layer on the drops of Hg or Ga. C. R. H.

Streaming phenomena at mercury cathodes. M. VON STACKELBERG, H. J. ANTWEILER, and L. KIESELBACH (Z. Elektrochem., 1938, **44**, 663—674).—Theoretical. Explanations of streaming anomalies at cathodes are reviewed, and experiments illustrating the phenomena are described. C. R. H.

Electrochemical polarisation. Reaction of the hydrogen electrode with oxidising agents, and determination of p_H in their presence. A. E. LORCH (Trans. Electrochem. Soc., 1938, **74**, Preprint 23, 349—356).—On polarising the H_2 electrode b O'' the rate of reaction depends primarily on the rate of diffusion (convection). For metallic electrodes of similar dimensions and surface characteristics the rate of diffusion is approx. const. J. W. C.

Mechanism of overvoltage. M. LOSCHKAREV and O. ESSIN (J. Phys. Chem. Russ., 1938, **11**, 410—419).—It is shown that different mechanisms of overvoltage may lead to identical expressions, and that the relation between c.d. and overvoltage alone is insufficient for determining this mechanism. J. J. B.

Overvoltage of hydrogen and solvents. I. I. S. NOVOSELSKI (J. Phys. Chem. Russ., 1938, **11**, 369—375).—The overvoltage of H_2 on Hg was measured in H_2O, MeOH, EtOH, and Et_2O. Tafel's equation holds for all the solvents. J. J. B.

Significance of the electrical properties of an insulating material. G. PFESTORF (Kunstharze, 1938, **8**, 218—223, 257—258, 260).—Various electrical terms are explained: dielectric const., power factor, dielectric loss factor, power loss, a.c. and d.c. resistance, dipole moment, dielectric angle of loss, surface resistance. F. McK.

Nature of the upper limit of inflammability of oxygen–hydrogen mixtures. M. V. POLJAKOV and I. E. NEIMARK (J. Phys. Chem. Russ., 1938, **11**, 555—568; cf. A., 1937, I, 251).—The upper pressure limit of inflammability of a $2H_2 + O_2$ mixture gradually disappears if the part of the quartz vessel which is filled with Pt wire is increased; the total length of the wire is irrelevant. The rate of the slow oxidation below the lower inflammability limit at 440° is increased by filling with wire such part of the vessel that the upper pressure limit would disappear, but it decreases if a larger part of the vessel

is obstructed by a Pt wire. The results are interpreted on the assumption that chain reactions can originate on the Pt surface, but this surface also breaks the chains originating in the space. Above the upper pressure limit the reaction occurs on the surface only. J. J. B.

Carbon monoxide–oxygen flame. IV. Influence of moisture on the intensity of the visible luminosity of the flame. E. KONDRATEEVA and V. KONDRATEEV (J. Phys. Chem. Russ., 1938, **11**, 331—337).—In presence of H_2O vapour [*e.g.*, 1 mm. (Hg) of H_2O for 30 mm. CO and 30 mm. O_2] CO is oxidised more completely but the luminosity of the flame is lowered. This decrease of the luminosity is too great for interpretation as due to extinction of luminescence; it reveals the reaction $CO + H_2O = CO_2 + H_2$. J. J. B.

Theory of the Bunsen flame. A. PREDVODITELEV (Tech. Phys. U.S.S.R., 1935, **2**, 364—368).—The application of the laws of hydrodynamics to the theory of the Bunsen flame by Michelson is criticised. It is assumed that the stable inner cone of the Bunsen flame is produced only when the velocity of flow at a given point in free space is equal to the normal velocity of the flame. A. J. M.

Primary decomposition of ethane, and the reaction between ethane and nitric oxide. T. J. GRAY, M. W. TRAVERS, and F. T. WHITE (Proc. Roy. Soc., 1938, **A**, **167**, 15—24).—The thermal decomp. of C_2H_6 and of C_2H_6–NO mixtures has been studied by the method of detailed analysis. The reduction of the rate of primary decomp. by the presence of NO is confirmed. A rapid reaction takes place between C_2H_6 and NO without increase of vol.; the product of this reaction was not isolated, but it appears to react with C_2H_6 to produce C_2H_4. The facts are not explicable on the theory of free radicals and an alternative explanation is proposed. G. D. P.

Two-stage auto-ignition of hydrocarbons and "knock." G. P. KANE (Proc. Roy. Soc., 1938, **A**, **167**, 62—80).—In the temp. range 270—400° ignition occurs by a two-stage process preceded by an induction lag t_1 before the formation of a cool flame and a second lag t_2 before the ignition of the cool flame products. An optical recording manometer, by means of which the two intervals t_1 and t_2 can be measured to an accuracy of 0·01 sec. at pressures up to 15 atm., is described. With C_3H_8 t_2 decreases more rapidly than t_1 with increasing initial pressure, and at a crit. pressure (~8 atm.) the two-stage is replaced by a single-stage process. With C_3H_6 the induction lags are much greater and no crit. pressure is observed. The kinetics of the process and the bearing of the results on the problem of knock in internal-combustion engines are discussed. G. D. P.

Projection of flame in gaseous mixtures and the phenomenon of knock in explosion engines.—See B., 1938, 1120.

Oxidation of chloroacetylene and bromoacetylene. L. A. BASHFORD, H. J. EMELÉUS, and H. V. A. BRISCOE (J.C.S., 1938, 1358—1364).—V.p. data are recorded for CH:CCl from −68·0° to −35·9° and for CH:CBr from −58·7° to −1·2°. The b.p. are −29·6° and 4·7°, and the latent heats 89 and 58 g.-cal. per g., respectively. The kinetics of the reactions between the vapours and O_2 have been studied. They have the characteristics of branching-chain reactions. Possible mechanisms are discussed. F. J. G.

Kinetics of the formation of a quaternary salt from gaseous constituents. A. GLADISCHEV and J. K. SIRKIN (J. Phys. Chem. Russ., 1938, **11**, 425—433).—The reaction $NEt_3 + MeI \rightarrow NMeEt_3I$ was followed by measuring the fall in pressure. It is heterogeneous and seems to occur on the salt surface rather than on that of glass. Its rate up to 50 mm. $\propto [NEt_3]$ and [MeI] and between 20° and 60° decreases with rise in temp. The apparent heat of activation is −1450 g.-cal. The rate of reaction is increased by vapour of $H_2O > MeOH > C_6H_6 > COMe_2$; this increase is <100%. J. J. B.

Autoxidation of quinol and of the mono-, di-, and tri-methylquinols.—See A., 1938, II, 441.

Period of induction in the interaction of potassium bromate and hypophosphorous acid. B. N. SEN (Coll. Czech. Chem. Comm., 1938, **10**, 321—329).—The formation of Br from $KBrO_3$ and H_3PO_2 is preceded by a period of induction which, when the concn. of one reactant is kept const., varies for 0·0007—0·0039M-$KBrO_3$ and 0·0075—0·0461M-H_3PO_2 inversely as the concn. of the other. The period is decreased by increase of temp. from 30° to 55°, by MeOH, EtOH, Pr$^\beta$OH, HCl, KBr, colloidal S, markedly decreased by $Na_2S_2O_3$, NH_4CNS, and $Na_2S_4O_6$, increased by Pr$^\alpha$OH, glycerol, Cl′, NO_3', SO_4'', citrate, tartrate, H_2SO_4, and ovalbumin. Addition of glass wool does not affect the induction period; hence the reaction is homogeneous. F. R. G.

Kinetics of unimolecular decomposition in solution. J. K. SIRKIN and M. A. GUBAREVA (J. Phys. Chem. Russ., 1938, **11**, 285—295).—The reactions $NPhMe_2 + CH_2PhI \rightleftharpoons CH_2Ph{\cdot}NPhMe_2I$ are measured in 0·005N alcoholic solution. Between 50° and 60° the equilibrium const. is $1{\cdot}2 \times 10^{-6}e^{13,700/RT}$, the velocity coeff. of the unimol. reaction is $6{\cdot}4 \times 10^{11}e^{-24,900/RT}$, and that of the bimol. reaction is $7{\cdot}7 \times 10^{5}e^{-11,200/RT}$. The results are discussed from the point of view of the transition state theory. J. J. B.

Acid and alkali hydrolysis of acetamide and acetonitrile in heavy water. O. REITZ (Z. Elektrochem., 1938, **44**, 693—695).—In 0·1N-acid the hydrolysis of NH_2Ac is 50% quicker in D_2O than in H_2O, but with increasing acid concn. the difference diminishes until in 3—4N-acid it is 15% slower in D_2O than in H_2O. In the alkaline hydrolysis of NH_2Ac and MeCN the difference between the rates in D_2O and H_2O is less than the difference for acid hydrolysis. In the latter there is a D–H exchange in the Me group. In the alkaline hydrolysis of MeCN, D–H exchange occurs quicker than the hydrolysis, but in the alkaline hydrolysis of NH_2Ac the D–H exchange is slower than the hydrolysis. C. R. H.

Effect of temperature variation on the benzoin reaction.—See A., 1938, II, 444.

Theory of tarnishing processes. III. C. WAGNER and K. GRÜNEWALD (Z. physikal. Chem., 1938, **B**, **40**, 455—475; cf. A., 1936, 792).—The speed of oxidation, v, of Zn to ZnO is independent of the O_2 pressure, whilst those of Cu to Cu_2O and Ni to NiO increase with increasing O_2 pressures. These facts are explained on the basis of diffusion gradient considerations within the oxide phases. For thicker Cu_2O layers v is determined by the diffusion of the $Cu^{\cdot}$ ion and electron within the Cu_2O phase, and the observed v agrees with the val. calc. from electrical conductivity and $Cu^{\cdot}$ transport no. in the Cu_2O phase. For thinner Cu_2O layers, however, v is largely determined by the speed of phase boundary reactions. A graphical method for determining the speed of phase reactions and diffusion processes is outlined. W. R. A.

Formation of water films at solid–gas interfaces and their influence on metal dissolution. F. TÖDT (Z. Elektrochem., 1938, **44**, 578—579).—The initial velocity of corrosion of Fe by a H_2O film is reduced, within a few sec., to a val. approx. 0·01 of the original val. C. R. H.

Verification of the law of combustion of parallel layers of colloidal powders.—See B., 1938, 1235.

Conditions for initiation and propagation of detonation in solid explosives.—See B., 1938, 1235.

Determination of spontaneous ignition points [of solid and liquid fuels].—See B., 1938, 1120.

Kinetics of oxidation of naphthenic oils by oxygen.—See B., 1938, 1121.

Oxidation of phosphorus vapour and hydrogen phosphide with oxygen in presence of nitric acid.—See B., 1938, 1156.

Catalytic oxidation of iodides by persulphates. VI. Mechanism of the effect of organic catalysts. P. V. AFANASIEV (J. Phys. Chem. Russ., 1938, **11**, 376—383).—It is suggested that S_2O_8'' oxidises the semiquinonoid form (I) of the catalyst to its holoquinonoid form (II) which oxidises I' to I_2. The reactions between S_2O_8'' and (I) and between (II) and I' are quicker than that between S_2O_8'' and I' because (I) and (II) are positively charged [in the case of a diamine (I) is a uni- and (II) is a bi-valent cation] and meet the anions S_2O_8'' and I' much more often than these meet together. This suggestion explains many of the results obtained (cf. A., 1938, I, 464). It is also applicable to many enzymic reactions. J. J. B.

Influence of alkyl groups on reaction velocities in solution. II. Base-catalysed prototropy of phenyl alkyl ketones. D. P. EVANS and J. J. GORDON. **III. Alkaline hydrolysis of saturated aliphatic esters.** D. P. EVANS J. J. GORDON, and H. B. WATSON (J.C.S., 1938, 1434—1439, 1439—1444; cf. A., 1936, 941).—II. The velocities of the acetate-catalysed bromination of the series of ketones $CH_2R{\cdot}COPh$ (R = H, Me, Pr^{α}, Pr^{β}) and of $COPhPr^{\beta}$, and also of the acid-catalysed bromination of $COPhBu^{\alpha}$, have been studied, and the effects of the substituents on the vals. of P and E in the equation $k = PZe^{-E/RT}$ are discussed.

III. The velocities of alkaline hydrolysis of the series of esters RCO_2Et (R varying from Me to C_7H_{15}) have been studied and the effects of the substituents on the vals. of P and E in the above equation are discussed. F. J. G.

Organic catalysts of the Wurtz reaction. D. L. TALMUD (J. Phys. Chem. Russ., 1938, **11**, 526—532).—The yield of NaI in the reaction between $Bu^{\alpha}I$ and Na in Et_2O is increased many times by CPh_2O, $(CPh_2{\cdot})_2$, and $(CMePh{\cdot}N)_2$. The rate of the reaction rises on addition of CPh_2O and reaches a const. val. when $[CPh_2O] : [Bu^{\alpha}I] = \sim 0{\cdot}005$. Only those substances show a catalytic activity which add two Na to one double bond; the additive product, *e.g.*, $CPh_2Na{\cdot}ONa$, is the real catalyst. J. J. B.

Catalytic activity of charcoal in the reaction between bromine and hydrogen. B. BRUNS and O. ZARUBINA (J. Phys. Chem. Russ., 1938, **11**, 300—304).—A mixture of H_2 and Br vapours was passed through a layer of charcoal and was then analysed. The rate of reaction $\propto [H_2]$. It increases with the temp. (120—190°); the "activation energy" is 30 kg.-cal. The C was prepared by heating sucrose-C in CO_2 at 850°. Its catalytic activity first rose and then declined with increasing time of heating. A max. in its adsorptive capacity towards Br was reached after a shorter time of heating than the max. of its catalytic activity. J. J. B.

Kinetics of the catalytic synthesis of ammonia. M. T. RUSOV and V. A. ROITER (J. Phys. Chem. Russ., 1938, **11**, 390—399).—The rate of NH_3 formation in presence of an industrial catalyst at 450° $\propto [H_2][N_2]^{0{\cdot}5}p^{-0{\cdot}25}$, p being the total pressure. The factor $p^{-0{\cdot}25}$ is due to an inhibition by adsorbed NH_3; when p is >10 atm. the adsorption of NH_3 becomes practically independent of p, and the factor $p^{-0{\cdot}25}$ disappears. The adsorption of NH_3 by the working catalyst can be estimated by a rapid cooling of the catalyst and analysis of the gases occluded in it. The rate of formation is max. at $[N_2] : [H_2] = 1 : 2$. The activation energy between 400° and 475° is 9 kg.-cal. J. J. B.

Rôle of sorption of nitrogen in the synthesis of ammonia in the presence of industrial iron catalysts. S. S. GAUCHMAN and V. A. ROITER (J. Phys. Chem. Russ., 1938, **11**, 569—577).—The rate of sorption of H_2 and of N_2 was measured between −184° and 450°. Two types of activated sorption of H_2 and at least one type of activated sorption of N_2 were observed. At 375° the rate of NH_3 formation is of the same order of magnitude as that of the N_2 sorption, but the activation energy of the NH_3 synthesis is < that of the N_2 sorption. J. J. B.

Active oxides and reactions of solid substances. CXIII. States of mixed catalysts as determined by mixture relations and thermal pretreatment, illustrated by the system zinc oxide–ferric oxide. G. F. HÜTTIG (Z. Elektrochem., 1938, **44**, 571—577).—A lecture (cf. A., 1938, I, 410). C. R. H.

Decomposition of citric acid by ferric iron.—See A., 1938, II, 428.

Application of catalysis in industry.—See B., 1938, 1109.

Chromium–vanadium catalyst with a high velocity coefficient.—See B., 1938, 1156.

Reaction mechanism of a graphite electrode with a reversing direct current. V. SHIVONEN (Z. Elektrochem., 1938, **44**, 659—662).—Earlier work by the author on electrolysis with graphite electrodes is described, together with additional experiments on the electrolysis of H_2SO_4, NaOH, and Na_2SO_4, in some of which CH_2O and $CH_2(OMe)_2$ have been detected. A possible mechanism is suggested. C. R. H.

Electrolysis of mixtures of nitrates with salts of methylethylacetic acid.—See A., 1938, II, 428.

Ammonia in the electrodeposition of brass.—See B., 1938, 1176.

Electrodeposition of aluminium from aluminium bromide solutions.—See B., 1938, 1176.

Electrolysis of alkali chlorides with the aid of mercury cathodes.—See B., 1938, 1180.

Photochemical investigations in the Schumann ultra-violet. VI. Mechanism of the photochemical hydrogen–oxygen reaction compared with the thermal hydrogen–ozone reaction. W. GROTH and P. HARTECK (Z. Elektrochem., 1938, **44**, 621—627).—H_2–O_2 mixtures containing 0·3—8·0% of O_2 yield O_3, H_2O, and HO_2 when subjected to light of λλ 1470 and 1295 A. The mechanism of the reaction is discussed and the conclusion is reached that activated O_3 mols., instead of decomp. into O_2 and O, attack H_2 mols. forming H_2O and HO_2. The theory is supported by data for the thermal H_2–O_3 reaction. C. R. H.

Photochemical studies. XXVII. Effect of radiation on mixtures of nitrogen dioxide and nitrous oxide and its relationship to the photochemical decomposition of nitrous oxide. F. C. HENRIQUES, jun., A. B. F. DUNCAN, and W. A. NOYES, jun. (J. Chem. Physics, 1938, **6**, 518—522).—The photochemical decomp. of N_2O has been investigated to test the validity of the postulated theory of one primary process (*a*) $N_2O + h\nu = N_2 + O$ and two secondary processes (*b*) $N_2O + O = 2NO$ and (*c*) $O + O\ (+M) = O_2\ (+M)$. O atoms are obtained from the photochemical decomp. of NO_2 by ultra-violet radiation and these do not combine with N_2O, showing that (*b*) is unlikely. The results favour the alternative explanation of two primary processes (*a*) and (*d*) $N_2O + h\nu = NO + N$ and a subsequent secondary reaction (*e*) $N + N_2O = NO + N_2$. W. R. A.

Photochemistry of carbon monoxide. P. HARTECK, W. GROTH, and K. FALTINGS (Z. Elektrochem., 1938, **44**, 621).—Light of λ 1295 A. decomposes CO quantitatively into CO_2 and C_3O_2. The val. of the heat of dissociation lies between 193 and 219 kg.-cal. H_2–CO mixtures containing <1% O_2 give H_2O and HO_2, but if CO be absent, no HO_2 is formed. C. R. H.

Photochemical reactions between iron pentacarbonyl and ammonia. F. P. FEDOROV and D. L. TALMUD (J. Phys. Chem. Russ., 1938, **11**, 352—355).—$Fe(CO)_5$ and NH_3 in the vapour phase in visible light give a small amount of $CO(NH_2)_2$ and other (unidentified) products. J. J. B.

Spectral investigation of the energetics of the Herschel effect. J. N. GOROCHOVSKI and S. A. SCHESTAKOV (J. Phys. Chem. Russ., 1938, **11**, 356—368).—A photographic plate is irradiated by white light. A part of it is developed and shows the density of blackening D_0. Another part absorbs E_λ ergs of light having the wave-length λ, and is then developed; its density is $D_0 - \Delta D$. $A_\lambda = \Delta D/E_\lambda$ is the sp. intensity of the Herschel effect. It is small at λ <600 mμ. and >900 mμ. and shows a max. between λ = 700 and 800 mμ. The higher is D_0 the shorter is λ of the threshold and of the max.; at λ <650 mμ. the secondary irradiation intensifies or weakens the primary image according to whether D_0 is small or large. The λ of the max. is increased by sensitising the plates; desensitising the plates by large additions of KBr shifts the max. to λ <620 mμ. The results are explained on the assumption that the Herschel effect is due to destruction of colloid Ag particles by light. J. J. B.

"Critical quantum number" in photography. III. Stratified specimen of a polydisperse emulsion. S. P. SCHUVALOV (J. Phys. Chem. Russ., 1938, **11**, 384—389).—The relation between the no. of developable nuclei in a photographic plate and their total no. and the no. of photons spent in irradiating the plate is calc. J. J. B.

Photochemical equivalent in optical sensitising. S. E. SHEPPARD, R. H. LAMBERT, and R. D. WALKER (Nature, 1938, **142**, 478—479).—A continuation of former experiments (A., 1938, I, 151) shows that both with erythrosin, an acid dye, and with polymethine basic dyes, vals. for the photochemical equiv. approximate to unity, *i.e.*, for each quantum of light adsorbed per mol. of dye one atom of Ag is produced, at least, in the initial high-efficiency region of the adsorption. Scheibe's hypothesis (A., *ibid.*, 90) is unnecessary, and for the region studied is incorrect. L. S. T.

Photochemical polymerisation of methyl acrylate vapour. H. W. MELVILLE (Proc. Roy. Soc., 1938, **A, 167**, 99—121).—The reaction is studied in the temp. range 20—150° at pressures up to 60 mm.; at λλ <2537 A. the mol. dissociates to H and propiolic ester. The temp. coeff. of polymerisation is negative. The effect of O_2 and butadiene as inhibitors of the reaction is investigated in some detail, and the results are used to measure the energy of activation of the propagation reaction. The behaviour of Me acrylate is compared with that of Me methacrylate previously studied (A., 1938, I, 261). G. D. P.

Photodichroism of cyanine. S. NIKITINE (Compt. rend., 1938, **207**, 462—464).—Measurements of the dichroism of collodion films containing cyanine after bleaching by insolation are described and discussed. The results are in agreement with the author's theory (A., 1938, I, 318, 528). A. J. E. W.

Photochemistry of reversible redox processes. II. Photochemical equilibrium of the type $A + BH_2 \underset{h\nu_B}{\overset{h\nu_A}{\rightleftharpoons}} AH_2 + B$, **with** *A* **and** *B* **as photo-**

active components in the visible spectrum. G. HOLST (Z. physikal. Chem., 1938, **182**, 321—340).—The action of light of various λλ in the visible region on the redox equilibrium between methylene-blue (I) and NHPh·NH·SO_3H has been investigated. The equilibrium depends principally on the relative absorptions of the H-acceptors (I) and NPh:N·SO_3H (II). The mol. extinction coeff. of (I) in the red and yellow region is ≫ that of (II) in the blue and violet region. The double absorption band of (I) in the red region is attributable to equilibrium between single and double mols., the equilibrium const. $[A]^2/[A_2]$ being about 10^{-4}. Quantum yields of both the forward and back reactions have been determined under various conditions. J. W. S.

Photochemical decomposition of *l*-ascorbic acid.—See A., 1938, II, 391.

Formaldehyde formation in the photo-oxidation of organic compounds.—See A., 1938, II, 430.

Polymerisation of acetylene by slow electrons. G. GLOCKLER and F. W. MARTIN (Trans. Electrochem. Soc., Preprints, 1938, **74**, 239—253).—The polymerisation of C_2H_2 by 40—90-e.v. electrons has been studied in a flow system by following the pressure change with a Pirani gauge. The determination of the no. of mols. reacting per ion-pair (M/N) is rendered difficult by the occurrence of secondary electrons, which cannot be allowed for accurately in the current measurements. The estimated max. val. of M/N is 8. A yellow solid polymeride (cuprene ?) has been isolated. A. J. E. W.

Influence of atomic hydrogen on the synthesis of ammonia by impact of positive ions. A. GELBERT and I. MOTSCHAN (J. Phys. Chem. Russ., 1938, **11**, 338—344).—Na^+, K^+, and Cs^+ induce NH_3 formation only when their velocities exceed a threshold val. At higher velocities the rate of the NH_3 formation is almost independent of the field applied, although the ionic current increases with increasing voltage so that the NH_3 yield per ion decreases with increasing voltage. If a source of H atoms (a hot W wire) is present, the yield is high (0·15—0·3) and almost independent of the voltage. Probably the reaction between N and H atoms takes place on the walls of the vessel. J. J. B.

Precipitation stimuli. N. P. SMIRNOV (Utschen. Zap. Univ. Kazan, 1937, **97**, No. 8, 3—14, 15—32; cf. A., 1935, 1328).—A mathematical treatment of the co-pptn. of salts with a common ion is given. J. J. B.

Exchange of acetic acid and acetate with heavy water. L. D. C. BOK and K. H. GEIB (Z. Elektrochem., 1938, **44**, 695; cf. A., 1938, II, 169). C. R. H.

Inhibition of the ammoniacal silver oxide precipitation in presence of small amounts of ammonium nitrate. T. MILLNER (Z. anal. Chem., 1938, **114**, 26—30).—The prevention, by small amounts of NH_4NO_3 or HNO_3, of the pptn. of Ag_2O from aq. $AgNO_3$ by aq. NH_3 can be satisfactorily explained by a consideration of the equilibrium conditions in the reactions (Reychler, A., 1904, ii, 403) $AgNO_3 + 2NH_4OH = Ag(NH_3)_2NO_3 + 2H_2O$ and $Ag(NH_3)_2NO_3 + AgNO_3 + 2H_2O \rightleftharpoons 2AgOH + 2NH_4NO_3$. L. S. T.

Magnesium carbonate trihydrate, basic carbonate, new double compounds of magnesium carbonate, and basic magnesium sulphate. J. D'ANS and G. GLOSS (Kali, 1938, **32**, 155—158).—Methods for the prep. of magnesite; basic carbonates with $MgO : CO_2 : H_2O = 1 : 0{\cdot}68—0{\cdot}85 : 2$; $Mg(OH)_2,4MgCO_3,7H_2O$ as spherical, doubly-refracting crystals; $MgCl_2,MgCO_3,7H_2O$, hygroscopic crystals, n_α 1·49, n_β 1·47, n_γ 1·46, stable between −12° and 25°; $2MgCO_3,MgCl_2,6H_2O$ (very hygroscopic); $MgBr_2,2MgCO_3,6H_2O$; $MgBr_2,MgCO_3,7H_2O$ (very unstable); and possibly $MgI_2,MgCO_3,7H_2O$; $Rb_2CO_3,MgCO_3,4H_2O$; $MgSO_4,3Mg(OH)_2,6H_2O$; and $MgSO_4,5Mg(OH)_2,8H_2O$ are described. Double carbonates with Cs, and compounds of $MgCO_3$ with $Mg(NO_3)_2$ or $MgSO_4$, were not obtained (cf. A., 1936, 689). By boiling an aq. suspension while air is passing, $MgCO_3,3H_2O$ is quickly converted into a basic carbonate which is gradually changed into $Mg(OH)_2$. L. S. T.

Mixed crystal formation with tricalcium silicate and tricalcium aluminate. W. JANDER and J. WUHRER (Zement, 1938, **27**, 377—379).—*X*-Ray powder diagrams of the products of heating $2CaO,SiO_2 + CaCO_3 + Al_2O_3$ (24 hr. at 1400°) and $3CaO,SiO_2 + 3CaO,Al_2O_3$ (20 hr. at 1350°) indicate that 6—7% of aluminate dissolves in the silicate without alteration of the lattice const. This may be explained by assuming that 10 Al replaces 3Ca + 6Si in the mixed crystals. G. H. C.

Organic derivatives of scandium and of yttrium.—See A., 1938, II, 435.

Reaction of phosphoric anhydride with nitrogen dioxide and with nitric oxide. E. M. STODDART (J.C.S., 1938, 1459—1461).—When P_2O_5 is heated with NO_2 the *compound* $P_2O_5,2NO$ is formed with liberation of O_2. It is also formed by direct union of P_2O_5 and NO. The observations of Smith (A., 1928, 953) were incorrectly interpreted; no compound P_2O_5,xNO_2 is formed, and his conclusions as to the effect of intensive drying on the system NO_2–NO–O_2 are invalid. F. J. G.

Demonstration of the influence of acidity on the reactions of intermediate products formed in the reduction of chromic acid. R. LANG (Mikrochim. Acta, 1938, **3**, 113—115).—The formation of intermediate unstable valency states of Cr during the reduction of CrO_4'' is demonstrated by the fact that, unlike CrO_4'' and Cr''' solutions, a solution of CrO_4'' to which AsO_2' has been added causes oxidation of "ferroine" [*o*-phenanthroline-Fe^{II}] in 2N-H_2SO_4 and a reducing effect on "ferriine" in 0·3N-acid. The reversal of the process is attributed to variation of the energetics of the reaction with acidity. J. W. S.

Preparation of violet chrome alum. R. A. CRESPI GHERZI (Rev. Fac. Cien. Quím. La Plata, 1936, **11**, 17—19).—Formation of the green isomeride is prevented by saturating a cooled solution of $K_2Cr_2O_7$ in H_2SO_4 with SO_2 until the violet colour appears. F. R. G.

Chromium diguanides, phenyldiguanides, and bisdiguanides.—See A., 1938, II, 435.

Chrome-tanning liquors.—See B., 1938, 1203.

Concentration of chlorine isotopes by centrifuging. J. W. BEAMS and A. V. MASKET (Physical Rev., 1937, [ii], **51**, 384).—CCl_4 has been separated into light, medium, and heavy fractions in an air-driven centrifuge. Vals. of ρ of the fractions are in approx. agreement with theory. L. S. T.

Complex compounds of iron sulphate and sulphite-cellulose extract.—See B., 1938, 1203.

Atmospheric corrosion of iron.—See B., 1938, 1167.

Corrosion of steel.—See B., 1938, 1169.

Corrosion of iron and lead in soils.—See B., 1938, 1206.

Compounds of hexamethylenetetramine with simple and double salts of cobalticyanic acid and the nature of residual affinity.—See A., 1938, II, 434.

Preparation of pure platinum. N. COLLARI and A. BATTAGLIA (Annali Chim. Appl., 1938, **28**, 310—318).—$(NH_4)_2PtCl_6$ is reduced by H_2 at 800° and the finely-divided Pt washed free from Fe etc. with conc. HCl; this process having been thrice repeated, the Pt is dissolved in HNO_3–HCl and electrolytically (1·2 v., 0·05 amp. per sq. cm.) separated in 0·4% H_2SO_4 at 60° (Ir remains in solution). The Pt is finally recovered by dissolution in HNO_3–HCl, conversion into $(NH_4)_2PtCl_6$, etc. The Pt is fused on CaO with the O_2–H_2 flame and the purity is determined spectrographically. F. O. H.

Ammines. IX. Diaquo-, hydroxoaquo-, and acidohydroxo-diammines of bivalent platinum. H. J. S. KING (J.C.S., 1938, 1338—1346).—*cis*- and *trans*-*Dipicratodiamminoplatinum*, *cis*-$[Pt(NH_3)_2(C_6H_2O_7N_3)_2],4H_2O$ and *trans*-$[Pt(NH_3)_2(C_6H_2O_7N_3)_2],3H_2O$, are described. *cis*- and *trans*-Sulphatodiamminoplatinum exist respectively as *monohydrate* and *dihydrate* (cf. Cleve, K. Svensk Vet. Akad. Handl., 1872, **10**, No. 9). Measurements of Λ and p_H show that these and the nitratodiammines exist in aq. solution as diaquodiammino-salts, and that these are in equilibrium with hydroxo-salts. The diaquo-salts could not be isolated but the following *hydroxo-salts* have been obtained: *cis*-$[Pt(NH_3)_2(NO_3)(OH)]$; *trans*-$[Pt(NH_3)_2(NO_3)(OH)],0·5H_2O$; *cis*- and *trans*-$[Pt(NH_3)_2(C_6H_2O_7N_3)(OH)]$; *cis*- and *trans*-$[\{Pt(NH_3)_2(OH)\}_2SO_4],2H_2O$ (I); *cis*- and *trans*-$[Pt(NH_3)_2(OH)_2]$. The dichloro- and dinitro-diammines are not aquotised in solution, but the *chloro*- and *nitro-hydroxodiammines*, *cis*-$[Pt(NH_3)_2(OH)Cl],0·5H_2O$ and *cis*-$[Pt(NH_3)_2(OH)(NO_2)]$, have been obtained from *cis*-(I) and $BaCl_2$ or $Ba(NO_2)_2$. F. J. G.

Determination of p_H of soil.—See B., 1938, 1207.

Potentiometric titration of sodium salts of fatty acids. P. EKWALL (Kolloid-Z., 1938, **84**, 284—291).—The p_H of soap solutions can be determined by the H_2 or quinhydrone electrode. The solutions can be titrated potentiometrically with HCl with the aid of the quinhydrone or glass electrodes. The results of conductometric and potentiometric titration methods are compared. A nephelometric method, indicating the separation of free fatty acid, is reported, and some results are compared with conductometric titrations. E. S. H.

Chlorometry; Pontius' method. RIZARD (J. Pharm. Chim., 1938, [viii], **28**, 208—216).—Determination of Cl by $NaHCO_3$–KI is discussed. The reaction is held to proceed by way of ICl or by formation of NaOI. R. S. C.

Hypohalogenites in volumetric analysis. I. Hypobromite. O. TOMÍČEK and M. JAŠEK. **II. Hypochlorite and hypobromite.** O. TOMÍČEK and P. FILIPOVIČ (Coll. Czech. Chem. Comm., 1938, **10**, 353—367, 340—352).—I. At the optimum concn. of 0·1N-NaOBr and 0·5N-NaOH solutions kept in a cool, dark place, the titre changes irregularly, and is best determined by AsO_3''' or Tl in excess of NaOH. The end-point must be determined potentiometrically. Determination of I′, S_2O_3'', SO_3'', and CNS′ gives high results.

II. Accurate determination of I′, S_2O_3'', and CNS′ titrated with hypobromite is possible according to the method of Kolthoff and Stenger (A., 1935, 595) using $Ca(OCl)_2$ and KBr. Accurate vals. are obtainable, and the solution kept in the dark or in brown bottles is much more stable than that of NaOBr. F. R. G.

Volumetric determination of fluoride and silicofluoride ions. W. GEFFCKEN and H. HAMANN (Z. anal. Chem., 1938, **114**, 15—21).—F′ and SiF_6'' are determined with an accuracy of ~1% by acidifying the solution with a known excess of HCl and titrating with KOH and K_2SiO_3 using suitable indicators. The method is based on the reaction $6F' + SiO_2 + 2H_2O \rightleftharpoons SiF_6'' + 4OH'$. L. S. T.

Determination of fluorine in foods.—See B., 1938, 1226.

Hydrogen-reduction method for determination of oxygen in steel.—See B., 1938, 1170.

Determination of oxygen in alloy steels.—See B., 1938, 1170.

Characteristic light phenomenon for the detection of sulphur compounds. E. SCHRÖER (Z. physikal. Chem., 1938, **B**, **40**, 450—454).—The production of a characteristic blue colouring in the heart of a H_2 flame by S or gaseous S compounds is explained as the process of re-combination of the H atom with the S_2 mol., the excitation energy of which is equal to the heat of recombination of the H atom in resonance. W. R. A.

Determination of sulphur in alloys.—See B., 1938, 1173.

Determination of forms of sulphur in insoluble residues from hydrogenated coal.—See B., 1938, 1117.

Assay of sulphur ointments.—See B., 1938, 1228.

[Determination of hydrogen sulphide and carbon disulphide in air from viscose factories.]—See B., 1938, 1236.

Micro-determination of sulphate.—See A., 1938, III, 972.

Conductometric analysis of mixed sulphuric and butylsulphuric acids.—See B., 1938, 1132.

Electrometric determination of free sodium hyposulphite in reduced indigo preparations.—See B., 1938, 1136.

Use of persulphate in the determination of nitrogen without distillation. K. STEINITZ (Mikrochim. Acta, 1938, **3**, 110—112).—In the Rappaport method (cf. A., 1938, III, 462) only 0·1 g. of $Ti(OH)_4$ is used per 100 c.c. of digesting solution. The material containing $0·02—0·35 \times 10^{-3}$ g. of N is heated with 2 c.c. of this solution until a brown colour appears. H_2O is added and then 0·1 g. of $K_2S_2O_8$. Digestion is continued until the solution is colourless and white vapours appear. After cooling, 2—3 c.c. of H_2O are added. If no yellow colour appears $>0·3 \times 10^{-3}$ g. of $K_2S_2O_8$ remains. The solution is again heated until H_2SO_4 fumes are evolved, cooled, neutralised, and titrated as in the Rappaport method. J. W. S.

Determination of water-soluble nitrogen in cyanamide.—See B., 1938, 1155.

Direct determination of ammonia in water.—See B., 1938, 1241.

Determination of ortho-, pyro-, and meta-phosphoric acids by colorimetric p_H titrations. A. B. GERBER and F. T. MILES (Ind. Eng. Chem. [Anal.], 1938, **10**, 519—524).—The acid containing 73—88% P_2O_5 is diluted in such a manner as to avoid hydration; equal portions of the diluted solution are titrated with NaOH, one to p_H 4·4 (bromocresol-green), and the other to p_H 8·8 (thymol-blue or oleo-red B) in presence of added $NaNO_3$ or NaCl. Aq. $AgNO_3$ is added in excess to either solution to form the normal Ag salts and the resultant acid is titrated (Me-red) with NaOH. From the data obtained the proportions of H_3PO_4, HPO_3, and $H_4P_2O_7$ are calc. L. S. T.

Spectro-photometric determination of ortho-phosphate and sodium ions. A. LECLÈRE (J. Pharm. Chim., 1938, [viii], **28**, 152—158).—The fluid containing $<0·5$ mg. of P_2O_5 with a NaOAc–aq. AcOH mixture (2 c.c.) and 4% U acetate (2 c.c.) at 100° in 5 min. affords a ppt. which when suitably washed and dissolved in dil. HCl affords with $K_4Fe(CN)_6$ in 20 min. a brown colour which is measured spectrophotometrically. 5 mg. of P_2O_5 per l. can be detected. A strongly acid solution of a Na salt with excess of the reagent (details given) affords at room temp. a ppt. which when washed and treated as above affords a colour applicable to spectro-photometric determination. J. L. D.

Determination of phosphoric acid in soil and fertilisers.—See B., 1938, 1206, 1207.

Determination of arsenic in brewing materials and wine.—See B., 1938, 1216, 1217.

Determination of arsenic, antimony, and tin in lead-, tin-, and copper-base alloys.—See B., 1938, 1171.

Evaluation of commercial arsenious oxide by titration with iodine.—See B., 1938, 1155.

Determination of boron in steel by special organic reagents.—See B., 1938, 1170.

Determination of boric acid in food products.—See B., 1938, 1226.

Determination of silica in quartzites by evaporation with hydrofluoric acid. T. KVIST (Z. anal. Chem., 1938, **114**, 21—26; cf. A., 1937, I, 45).—In routine determinations of SiO_2 in quartzites evaporation with HF in presence of H_2SO_4 does not give correct vals., but one evaporation with HF alone gives a result that is apparently correct. Repeated evaporations in order to reach const. wt. give results that are too high. L. S. T.

Determination of carbon monoxide and oxygen in industrial gases.—See B., 1938, 1156.

Detection of hydrogen cyanide [in air].—See B., 1938, 1236.

Determination of potash in fertilisers.—See B., 1938, 1207.

Colorimetric determination of sodium as uranyl manganese sodium acetate. W. C. WOELFEL (J. Biol. Chem., 1938, **125**, 219—227).—The reagent is prepared from solutions of (*a*) $UO_2(OAc)_2,2H_2O$ (80 g.), 30% AcOH (46 ml.), and H_2O (to make 520 g.), and (*b*) $Mn(OAc)_2,4H_2O$ (245 g.), 30% AcOH (23 ml.), and H_2O (to make 520 g.). (*a*) and (*b*) are mixed while hot, cooled to room temp., and one third of their vol. of 95% EtOH is added. After 24 hr., 0·2 g. of pptd. $NaMn(UC_2)_3(OAc)_9,6H_2O$ (I) is added to saturate the solution, which is filtered immediately before use. The sample (1 ml. containing $0·1—0·5 \times 10^{-3}$ g. of $Na^{\cdot}$) is treated with 8 ml. of this reagent, the solution centrifuged, and the ppt. is washed with a saturated solution of (I) in glacial AcOH. The ppt. is finally treated with 10 ml. of KIO_4 reagent (KIO_4 5 g., 85% H_3PO_4 100 ml., H_2O 800 ml.), the colour developed being compared with standards. The application of this method to the colorimetric determination of Na in urine and blood serum is discussed. J. W. S.

Sensitive [test for] detection of lithium. O. PROČKE and R. UZEL (Mikrochim. Acta, 1938, **3**, 105—107).—The reagent used is prepared by dissolving 2 g. of KIO_4 in 10 c.c. of 2N-KOH, diluting to 50 c.c., treating with 3 c.c. of 10% aq. $FeCl_3,6H_2O$, and diluting again to 100 c.c. This solution is stable. In the test a drop of neutral solution under test is treated with a drop of reagent. In presence of >5 μg. of Li an immediate ppt. is formed. If no ppt. is formed the mixture is heated for 1—2 min. in boiling H_2O, when a yellowish ppt. or cloudiness is obtained in presence of $>0·25$ μg. The test is unaffected by presence of K, Rb, and Cs, but NH_4 salts should be removed. The test is more sensitive in presence of $Na^{\cdot}$, and by saturating the test solution with NaCl about 0·05 μg. of Li can be detected. J. W. S.

Soap-solution method for determining hardness of water.—See B., 1938, 1241.

Micro-determination of calcium in water.—See B., 1938, 1241.

Determination of calcium and magnesium [in water and soils] by soap titration.—See B., 1938, 1241.

Determination of magnesium and manganese in fertilisers.—See B., 1938, 1208.

Palmitate determination of magnesia in water.—See B., 1938, 1241.

Determination of magnesia and lime in cooking salt.—See B., 1938, 1154.

Determination of small quantities of magnesia in limestone and [sugar] defecation slime.—See B., 1938, 1155.

Determination of metals in foods.—See B., 1938, 1226.

Determination of zinc in light aluminium alloys containing lead, copper, antimony, tin, iron, manganese, and magnesium.—See B., 1938, 1174.

Precipitation of cadmium as sulphide and its separation from zinc. C. ZÖLLNER (Z. anal. Chem., 1938, **114**, 8—15).—$Cd^{\cdot\cdot}$ is pptd. quantitatively by H_2S, in a form easy to filter, from solutions containing 15 c.c. of conc. H_2SO_4 per 100 c.c. Cl' must be absent. Quant. separation from $Zn^{\cdot\cdot}$ in different proportions is effected by a single pptn. in the same [H_2SO_4]. L. S. T.

Determination of lead [in spray residue].—See B., 1938, 1226.

Determination of lead in drinking water.—See B., 1938, 1241.

Potassium tungsten enneachloride as a reducing agent. R. UZEL and R. PŘIBIL (Coll. Czech. Chem. Comm., 1938, **10**, 330—339).—$K_3W_2Cl_9$ can be used in an atm. of CO_2 to replace $TiCl_3$ in the reductometric determination of Cu, Fe, Cr, Ce, MnO_4', or BrO_3', the end-point being measured potentiometrically or by the ink-blue colour of W^V. F. R. G.

Accuracy of the dithizone mixed colour titration. H. GRUBITSCH and J. SINIGOJ (Z. anal. Chem., 1938, **114**, 30—38).—The errors involved in the determination of Cu and Zn by means of the dithizone mixed colour titration method have been investigated. The error is large in the green and reddish-violet colour regions, but is a min. in the greyish mixed colour region, where the ratio colour change : added metal ion is a max. Comparative titrations to this mixed colour involve the min. errors, which are $\pm 1{\cdot}5\%$ for Cu and $\pm 2{\cdot}5\%$ for Zn. L. S. T.

Microchemical detection and determination of mercury. N. D. COSTEANU (Mikrochim. Acta, 1938, **3**, 136—140).—Filter-paper is soaked with the solution under test and dried. A drop of aq. HI is then applied and the colour produced compared with standard stains produced on papers soaked in solutions of $Hg^{\cdot\cdot}$ and $Hg_2^{\cdot\cdot}$ of known concn. J. W. S.

Internal electrolysis. IV. Determination of small quantities of mercury in presence of copper and zinc. J. G. FIFE (Analyst, 1938, **63**, 650—651; cf. A., I., 1937, 631).—Using apparatus described previously (A., 1936, 1479) with anodes of Cu wire, cathodes of Pt, anolyte of $CuSO_4 \equiv 5$ g. Cu and 2 ml. of 96% aq. H_2SO_4 per 100 ml., and catholyte of 300 ml. approx. containing the Hg as $Hg(NO_3)_2$, $CuSO_4$, $ZnSO_4$, and 6 ml. of 96% aq. H_2SO_4, the electrolysis is carried out at 60° for 30—40 min. 0·7—7 mg. of Hg may be so determined. HNO_3 and nitrates may be substituted for H_2SO_4 and sulphates. E. C. S.

Dimethylamino- and diethylamino-phenyliminocamphor. Reagents for mercury. M. SINGH (J. Indian Chem. Soc., 1938, **15**, 402).—Dimethylaminophenyliminocamphor in EtOH gives a deep scarlet colour with $Hg^{\cdot\cdot}$ salts and no colour with Pb, Cu, Ni, Co, Fe, Ca, Ba, Cd, Mn, and Mg salts. Bi and Ag salts give a faint pink colour and a slight, white ppt. The Et_2 compound gives with $Hg^{\cdot}$ and $Hg^{\cdot\cdot}$ a deep violet colour which disappears on passing O_2 into the solution, the colour reappearing on adding more reagent. Both reagents may be used on filter-paper for spot tests, the colour obtained with $Hg^{\cdot\cdot}$ disappearing and that with $Hg^{\cdot}$ becoming black on exposure to NH_3 vapour. The sensitivity in each case is 1 in 50,000. F. H.

Microchemical detection of europium in mixtures of rare earths. G. BECK (Mikrochim. Acta, 1938, **3**, 141—143).—In common with the lower valency states of Ti, Sn, V, Nb, Mo, W, U, and Re, $Eu^{\cdot\cdot}$ salts reduce cacotheline (I) to a violet dye. No other rare-earth metals give this reaction, and Eu can be detected in a solution containing these metals by reducing it with Zn and HCl in presence of (I). The limit of sensitivity of the test is 3 μg. per c.c. J. W. S.

Determination of aluminium in certain non-ferrous materials by use of ammonium aurintricarboxylate.—See B., 1938, 1176.

Determination of aluminium in cast iron.—See B., 1938, 1167.

Rapid determination of manganese in stainless steel.—See B., 1938, 1169.

Direct determination of iron in malt beverages.—See B., 1938, 1216.

Electrolytic analysis of nickel bronzes and light aluminium alloys.—See B., 1938, 1176.

Determination of nickel and boric acid in nickel-plating solutions.—See B., 1938, 1175.

Microchemical detection by means of redox action with chromic acid and a reducing agent. R. LANG (Mikrochim. Acta, 1938, **3**, 116—125).—Procedures are described for the microchemical detection of CrO_4'' with "ferriine" and H_2TeO_4, H_2TeO_4 with "ferriine" and $K_2Cr_2O_7$, CrO_4'' and TeO_4'' by induced oxidation of Br', and of CrO_4'', Mn, Ce, and V with $NHPh_2$. All the tests are based on the effects produced by unstable valency states of Cr. J. W. S.

Determination of chromium by alkaline mercuric oxide. P. RAYCHAUDHURY (J. Indian Chem. Soc., 1938, **15**, 317—320).—Cr^{III} salts, when boiled with HgO freshly pptd. from $HgCl_2$ and excess of NaOH, are quantitatively oxidised to Na_2CrO_4 in which the Cr is determined iodometrically. F. R. G.

Determination of small quantities of antimony in tartar emetic spray residues.—See B., 1938, 1210.

Rapid analysis of type metals.—See B., 1938, 1171.

Sensitive catalytic test for niobium and tantalum. A. S. KOMAROVSKI and M. J. SCHAPIRO (Mikrochim. Acta, 1938, **3**, 144—146).—The fact that the presence of substances capable of forming peracids causes reaction between S_2O_3'' and H_2O_2 to yield SO_4'' instead of S_4O_6'' (A., 1931, 1133) is applied to the detection of Nb and Ta. The reagent solution is freshly prepared from equal parts of 1% aq. $Na_2S_2O_3,5H_2O$, 25% aq. $BaCl_2$, 0·1N-AcOH, and 0·7% H_2O_2, and is mixed with an equal vol. of the solution under test, the opalescence produced being compared with that in a similar blank test. The method is capable of detecting 0·2 μg. of Nb or 0·4 μg. of Ta in 4 c.c. of solution. J. W. S.

Analysis of dental gold alloys.—See B., 1938, 1171.

Determination of gold and silver in cyanide [leach] solutions.—See B., 1938, 1172.

Thyratron-controlled thermostat. J. M. STURTEVANT (Rev. Sci. Instr., 1938, **9**, 276—279).—A modified form of the regulator described by Benedict (cf. A., 1937, I, 534) employs a resistance thermometer and phase-shifting thyratron circuit and gives continuous control accurate to ±0·003°. N. M. B.

Improved method of heat input control in glass fractionating columns. G. H. MOREY (Ind. Eng. Chem. [Anal.], 1938, **10**, 531—532).—The 12-l. Pyrex flask, suitably protected and insulated by asbestos, is heated electrically by three circuits of nichrome wire wound around the outside. L. S. T.

Application of the direct-fusion furnace to the helium method of determining the geologic ages of rocks. R. D. EVANS and C. GOODMAN (Physical Rev., 1937, [ii], **51**, 595).—With minor modifications, the furnace described previously (A., 1935, 723) can be used to release He from the boiling rocks at 2000°. L. S. T.

Apparatus for the determination of the variation of the coefficient of thermometric conductivity of disperse bodies. A. KURTENER and A. CHUDNOVSKI (Tech. Phys. U.S.S.R., 1937, **4**, 377—379).—The apparatus used previously is described. C. R. H.

Universal apparatus for micro-analytical purposes. F. HECHT (Mikrochim. Acta, 1938, **3**, 129—132).—An electrically-heated apparatus, suitable for drying micro-apparatus in a stream of dust-free air and for rapid evaporation of liquids, is described. The equipment can also be modified to enable these operations to be performed in vac. J. W. S.

Variable-angle liquid-prism spectrometer. T. V. STARKEY (J. Sci. Instr., 1938, **15**, 290—292).—An auto-collimating type instrument and its use in measuring n for liquids are described. N. M. B.

Permanence of absorption weakeners of antimony. G. O. LANGSTROTH and D. R. MCRAE (Rev. Sci. Instr., 1938, **9**, 282).—Sb films deposited on a quartz or glass surface at the exit of a heated tube through which a mixture of H_2 and SbH_3 is passed retain their transmission characteristics approx. const. for at least a year. N. M. B.

Use of an uncalibrated stepped wedge in quantitative spectrum analysis. L. ALIFANOVA and S. RAJSKI (Tech. Phys. U.S.S.R., 1937, **4**, 361—364).—Calibration of the wedge is not only unnecessary but also undesirable as it may introduce errors. C. R. H.

High-temperature Debye–Scherrer camera, and its application to the study of the lattice spacing of silver. W. HUME-ROTHERY and P. W. REYNOLDS (Proc. Roy. Soc., 1938, **A, 167**, 25—34).—A camera for recording X-ray powder diffraction patterns of specimens maintained at temp. >1000° is described. The parameter of the Ag lattice has been measured between 20° and 943° and the results are expressed in the form of an empirical equation. G. D. P.

Chemical analysis by X-ray diffraction. Classification and use of X-ray diffraction patterns. J. D. HANAWALT, H. W. RINN, and L. K. FREVEL (Ind. Eng. Chem. [Anal.], 1938, **10**, 457—512; cf. A., 1936, 1084).—Powder diffraction data for 1000 chemical substances are tabulated, and a scheme of classification which makes possible a routine use of the Hull method of X-ray analysis (A., 1919, ii, 470) is given. A survey of the apparatus required, the technique of obtaining and the method of interpreting the patterns, and the applications of X-ray diffraction is also given. L. S. T.

Precision powder camera for photographs at at high temperatures, and apparatus for measuring X-radiograms. F. SCHOSSBERGER (Z. Krist., 1938, **99**, 341; cf. A., 1938, I, 276).—Acknowledgment of the Seemann camera. I. McA.

Recording apparatus for the measurement of integrated intensities of X-ray reflexions. O. B. JACKSON and A. GOETZ (Physical Rev., 1937, [ii], **51**, 142). L. S. T.

X-Ray tube for crystal analysis and stress measurements. J. E. DE GRAAF and W. J. OOSTERKAMP (J. Sci. Instr., 1938, **15**, 293—303).—A high-output tube with earthed anode is described, and the factors determining the development of a tube for crystal analysis (brightness of the focal spot, its shape and load distribution, and the purity of the spectrum) are discussed. General expressions for the temp. of the focal spot and the temp. gradient at the cooled wall are deduced. N. M. B.

Microphotometer for analysing X-ray diffraction patterns of raw cotton fibre.—See B., 1938, 1139.

Use of the Lovibond tintometer in colorimetric analysis.—See B., 1938, 1169.

Simplified conductivity bridge assembly. G. M. EVANS (J. Chem. Educ., 1938, **15**, 389—391). L. S. T.

Method of mounting conductivity and potentiometer setups. P. E. HATFIELD and A. STRICKLER (J. Chem. Educ., 1938, **15**, 380—382). L. S. T.

New polarograph and its application. A. SCHMIDT (Z. Elektrochem., 1938, **44**, 699—708).—The construction and application of the instrument are described. C. R. H.

Electrode support for electrometric titrations. M. E. STANSBY (Ind. Eng. Chem. [Anal.], 1938, **10**, 529). L. S. T.

Electrolytic resistors for direct-current applications in measuring temperatures. D. N. CRAIG (J. Res. Nat. Bur. Stand., 1938, **21**, 225—233).—The resistors consist of glass capillaries filled with a solution of CuCl in HCl and EtOH, with Cu electrodes. They have a high temp. coeff. and high stability, and are suitable for use in meteorographs to measure temp. of −75° to 30°, to within 1°. A. J. E. W.

General theory of the double-focussing mass spectrograph. R. HERZOG and V. HAUK (Ann. Physik, 1938, [v], **33**, 89—106). O. D. S.

Application of electron test beams for micromanipulation. M. VON ARDENNE (Naturwiss., 1938, **26**, 562).—The use of a sharp convergent electron test-beam in connexion with the electron ultra-microscope is discussed. A. J. M.

Pulse chopper of the Geiger-Müller counter. M. KOZODAEV and G. LATISCHEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 21—23; cf. Getting, A., 1938, I, 160).—Factors affecting the time resolving power (τ) of counters are reviewed. A multivibrator system is designed for coincidence circuit; it uses resistances of ~1 MΩ, has flat characteristics (air- or A-filled tube), and τ, 3×10^{-4} sec., is the natural circuit period independent of counter processes. 1% of omissions occur at 10^3 pulses per min. I. McA.

Tube circuit for the Geiger-Müller counter. M. KOZODAEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 25—26).—It is shown why the circuit described, akin to that of Neher and Pickering (A., 1938, I, 277), fails, with lowered resistance, to reduce the pulse duration of the counter (cf. preceding abstract). I. McA.

Limiting sensitivity of an alternating-current method of measuring small magnetic moments. E. A. JOHNSON (Rev. Sci. Instr., 1938, **9**, 263—266).—The moment of small magnetic dipoles is measured by rotating the dipole inside a fixed coil and measuring the voltage induced in the coil by means of an a.c. amplifier. The limiting sensitivity is calc., and moments of 3×10^{-7}—8×10^{-8} c.g.s. unit can be detected. The method has been applied to the measurement of the polarisation in sedimentary deposits. N. M. B.

Laboratory apparatus for mixing small quantities of gas in a gas stream at constant ratio. A. VAN DER LINDEN (Chem. Weekblad, 1938, **35**, 664).—The main gas stream is measured by a gas-meter and passes through a constricted tube. By an arrangement of two respirators placed respectively in front of and behind the constriction, the second aspirator containing the gas to be added in small amount, the difference in pressure caused by the restriction is used to force the second gas into the main gas stream. Const. ratios of 0·1—1% can be maintained. Arrangements are made for filling the gas aspirator should it become empty. S. C.

Apparatus for examining firedamp and mine gases.—See B., 1938, 1118.

Portable instrument for analysis of hydrogen cyanide-air mixtures.—See B., 1938, 1154.

Silver membranes. H. J. READ and M. KILPATRICK (Trans. Electrochem. Soc., 1938, **74**, Preprint, 255—277; cf. A., 1933, 565; 1935, 931).—Apparatus and technique for the prep. of Ag membranes by distillation of Zn from sheets of a Ag–Zn alloy, and for the measurement of the permeability of the membranes to gases (k), are described. The effect of the alloy composition and of the time and temp. of distillation on ρ and k for the membrane are determined. Photomicrograms of typical membranes are given, the effect of reheating being illustrated. Vals. of the mean pore radius and no. of pores per unit area are calc. A. J. E. W.

Pyknometer. J. WESTBERG (Z. Spiritusind., 1938, **61**, 286—287).—In the described instrument, which is suitable for volatile liquids and those having low η, the thermometer (0—25°) is fused through the side of the bulb. A marked capillary neck to the bulb is surmounted by an expansion chamber closed with a ground stopper. A special funnel is provided for filling, and a capillary tube for drying. I. A. P.

Hydrogen sulphide generator. C. W. BENNETT (J. Chem. Educ., 1938, **15**, 377—379). L. S. T.

Lecture apparatus for [the collection of] gases. E. T. HOPPE (J. Chem. Educ., 1938, **15**, 369). L. S. T.

High-speed multi-jet oil diffusion pumps of metal construction. C. M. VAN ATTA and L. C. VAN ATTA (Physical Rev., 1937, [ii], **51**, 377). L. S. T.

Production of metal single crystals between 20 and 0·2 μ. J. RINEHART and A. GOETZ (Physical Rev., 1937, [ii], **51**, 147).—The liquid metal is sprayed by the application of gas at 100—150 atm. at a temp > the m.p. The resulting metal dust crystallises while hovering in an oil fog, and the particles are separated by sedimentation and centrifuging in order to obtain suspensions of crystals of equal size, which are then oriented crystallographically parallel. L. S. T.

Production of very thin beryllium flakes for a polonium–beryllium neutron source. T. R. FOLSOM (Physical Rev., 1937, [ii], **51**, 375).—A technique for producing very thin flakes of Be by a vac.-evaporation process, and the use of these flakes to produce an intense Po–Be neutron source conc. in a small vol., are described. L. S. T.

Rapid method for drying solid synthetic products. H. V. ALLISON (J. Chem. Educ., 1938, **15**, 379).—The arrangement described replaces the use of porous plates or an oven. 75—100 g. of wet material can be dried in 30—45 min. at room temp. L. S. T.

Use of isotopes in chemical investigation. K. H. GEIB (Angew. Chem., 1938, **51**, 622—626).—A review dealing with the use of radioactive indicators

(natural and artificial), and with the application of D for determining the course of reactions. Exchange experiments with isotopes other than D are also reviewed. A. J. M.

Determination of particle size and mol. wts. by centrifuges. P. VON MUTZENBECHER (Angew. Chem., 1938, **51**, 633—640).—A review dealing with the theory and technique of sedimentation analysis. A. J. M.

Electrostatic method of measuring elastic constants. D. BANCROFT and R. B. JACOBS (Rev. Sci. Instr., 1938, **9**, 279—281).—The method described employs a sensitive electrostatic pick-up for ascertaining the condition of resonance. Measurements of Young's modulus and the rigidity plotted for various temp. for a C-steel rod are accurate to 0·1%. N. M. B.

Greaseless stopcock. L. S. ECHOLS, jun. (Ind. Eng. Chem. [Anal.], 1938, **10**, 527).—A modified Hg-sealed stopcock, positive in action, insensitive to changes in temp., and eliminating hysteresis effects and loss of gas vol., is described. L. S. T.

Simplified portable McLeod gauge. E. W. FLOSDORF (Ind. Eng. Chem. [Anal.], 1938, **10**, 534). L. S. T.

Continuous extractor using hot solvent. T. R. P. GIBB, jun. (Ind. Eng. Chem. [Anal.], 1938, **10**, 547).—The continuous, automatic apparatus, which can be attached to any flask, employs solvents at the b.p.; since channeling and filter clogging are avoided, it is suitable for the extraction of adhesive, semi-solid tars, or gelatinous substances. The flow of solvent varies from 20 to 50 c.c. per min. Quantities of material much larger than usual can be dealt with. L. S. T.

Elimination of surface tension effects in specific gravity measurements. C. H. M. ROBERTS (Ind. Eng. Chem. [Anal.], 1938, **10**, 518—519).—A small drop of 1% aq. Na lauryl sulphate is added to the surface of the aq. solution after immersion of the plummet in order to ensure complete and reproducible wetting of the wire. Diffusion of the added substance into the solution is thus minimised; its effect on the d is negligible. L. S. T.

Compact self-regulating valve. L. WILLIAMS and A. H. W. BUSBY (Ind. Eng. Chem. [Anal.], 1938, **10**, 512).—The valve described maintains the rate of flow of gas into a vac. const. to within 10% for a variation in pressure from 28 to 2 in. of Hg. By a reverse arrangement of the needle, the valve can be adapted to the control of gas flow from a pressure source. L. S. T.

Surface tensiometer. H. N. HOLMES (Science, 1938, **88**, 223—224).—A modified Lloyds-Scarth (*ibid.*, 1926, **64**, 253) tensiometer is described. L. S. T.

Distillation apparatus. J. ERDÖS and B. MOLNÁR (J. Pharm. Chim., 1938, [viii], **28**, 216—219).—A compact apparatus avoiding exposure of the vapour to air is described. R. S. C.

Laboratory columns packed with silicon carbide. H. J. HALL and G. B. BACHMAN (Ind. Eng. Chem. [Anal.], 1938, **10**, 548—549; cf. B., 1936, 306).—Distillation columns packed with 3—6-mesh SiC compare favourably in efficiency with recently-developed packed columns, and can be used for most distillations of org. and inorg. substances. After use, efficiency is easily restored by refluxing with a suitable solvent or by boiling with HNO_3 or CrO_3 cleaning mixture. Test data for a mixture of C_6H_6 and $C_2H_4Cl_2$ are recorded, and the results of a comparison with metal packings are given. For the distillation of unstable halides or corrosive S compounds, SiC is advantageous. L. S. T.

"Twin tubes" for experiments with free radicals. L. ANSCHÜTZ (Ber., 1938, **71**, [*B*], 1902).—The apparatus consists essentially of two Schlenk tubes joined by a lateral tube. It is useful for the separation of a metallic ketyl solution from excess of metal, for the determination of the suitability of the experimental conditions for the prep. of unknown radicals, and for lecture experiments. H. W.

Geochemistry.

Determination of the meteorological conditions of the atmosphere by the use of radio-sounding balloons. H. A. THOMAS (Proc. Roy. Soc., 1938, **A**, **167**, 227—250).—The radio-transmitter, barometer, and thermometer units are described and the results of typical ascents are analysed. G. D. P.

Chemical composition of the rainfall in Holland. K. W. H. LEEFLANG (Chem. Weekblad, 1938, **35**, 658—664).—Analyses of the rainfall for colour, κ, solids, reducing power ($KMnO_4$), Cl, HNO_2, HNO_3, SO_4'', HCO_3', SiO_2, NH_4, albuminoid NH_3, CaO, MgO, alkali metals (Na), hardness, and carbonate hardness, in different seasons from 1933 to 1937, and at different distances from the coast, are recorded and discussed. S. C.

[Chemical and physico-chemical data for the air and thermal waters of] the Giusti grotto of Monsummano [Pistoia, Italy]. C. PORLEZZA and M. TRAMONTANO-GUERRITORE (Annali Chim. Appl., 1938, **28**, 281—289). F. O. H.

Metamorphism of ocean salt deposits. H. BORCHERT (Kali, 1938, **32**, 132—135, 143—146, 169—172).—A discussion, with especial reference to metamorphism by intrusive waters and to Jänecke's views. L. S. T.

Liberation of helium from [Travancore] monazite by heating. P. R. SUBBARAMAN and K. R. KRISHNASWAMI (Current Sci, 1938, **7**, 54—55).—40- and 80-mesh samples yielded 0·850 and 0·903 c.c. per g., respectively. For complete liberation of He in 4 hr. samples must be heated at 1000—1100°. L. S. T.

Internal structure of the earth; genesis of continents and oceans. A. DAUVILLIER (Compt.

rend., 1938, **207**, 452—454).—The internal composition and structure of the earth are discussed on analogy with meteorites. The surface structure is probably produced by similar processes to that of the moon, with which it is compared. H_2O in oceans is formed by reduction of ferrous metal oxides by H_2 during the cooling period. A. J. E. W.

Magnetic properties of the rocks constituting the earth's crust. I. Y. Katô (Sci. Rep. Tôhoku, 1938, [i], **27**, 91—100).—The effect of temp. on the magnetisation of lava in a weak field has been investigated by a method which is described. The susceptibility, which is dependent only on the amount of magnetite in the sample, reaches a max. at 200—250° and becomes zero at 625°. W. R. A.

Microscopical examination of non-opaque minerals. D. A. P. Wilson and V. L. Bosazza (J. Chem. Met. Soc. S. Africa, 1938, **38**, 539—543).—Grains of mineral concentrates are mixed with bakelite powder and briquetted by heating in a mould. Sections are then cut and examined in transmitted light. L. S. T.

Microscopical and chemical analyses of the Cambrian phosphorites from Sandomierz. W. Wawryk (Rocz. Pols. Tow. Geol. Krakow, 1932, **8**, 266—272).—Siliceous phosphate nodules are found in conglomerate. The amorphous and cryptocryst. phosphates consist of fluorapatite and F-free phosphorite. Ch. Abs. (*e*)

Solubility of quartz. C. S. Fox (Rec. Geol. Survey India, 1936, **69**, 423—425; Chem. Zentr., 1936, ii, 2323).—Attack of specimens of quartzite is attributed to some form of mollusc. A. J. E. W.

Size and specific gravity of seashore sand. Y. Ikeda, M. Aramata, and K. Yoneta (Mem. Fac. Eng. Hokkaido, 1938, **4**, 239—254).—Sp. gr., apparent sp. gr., porosity, and average diameter are tabulated for 206 seashore sands from Honsyu, Hokkaidô, and Karahuto. Frequency curves of these properties are plotted. L. S. T.

Origin of the Quebec phlogopite-apatite deposits. K. K. Landes (Amer. Min., 1938, **23**, 359—390; cf. A., 1938, I, 281).—The general geology, the deposits, the 21 minerals present and their paragenesis are described. Previous theories of the origin of the deposits are criticised and a new theory is advanced. L. S. T.

Petrographic and chemical study of the dacites of Draica, Hunedoara. V. Ianovici (Ann. Sci. Univ. Jassy, 1938, **24**, II, 303—313).—Constituent minerals are described and two chemical analyses are given. L. S. T.

Metalliferous deposits of Tulgheș. VII. Huian outcrop. A. Chelarescu (Ann. Sci. Univ. Jassy, 1938, **24**, II, 346—372; cf. *ibid.*, 1937, **23**, II, 316).—Rocks and minerals adjoining the deposit are described, together with the constituents of the ore, which are magnetite (I), pyrite, chalcopyrite, hæmatite (II), limonite, and maghémite [(II) produced by alteration of (I)]. L. S. T.

Römerite. C. W. Wolfe (Amer. Min., 1938, **23**, 468).—A correction (cf. A., 1937, I, 431). L. S. T.

Sedimentary copper, vanadium-uranium, and silver in south western United States. F. R. Koeberlin (Econ. Geol., 1938, **33**, 458—461).—A discussion concerning the origin of these deposits (cf. A., 1938, I, 218). L. S. T.

Talc deposits of N. Carolina. B. C. Moneymaker (Econ. Geol., 1938, **33**, 461—463; cf. A., 1938, I, 281).—The talc and the pseudodiorite of southwestern N. Carolina and the contiguous parts of Georgia were probably formed by hot solutions of magmatic origin. L. S. T.

Tungsten mineralisation at Oreana, Nevada. P. F. Kerr (Econ. Geol., 1938, **33**, 390—427).—Rock types of the area, the minerals of the pegmatites, the sequence of mineralisation, and the origin of the Oreana deposit are discussed. This deposit is unique among American W deposits in that the scheelite mineralisation is considered to be pegmatitic. Beryl, oligoclase, albite, phlogopite, fluorite, quartz, and scheelite (I) are the chief minerals. The two forms of (I) deposition are complex pegmatite dykes cutting metadiorite, and lens-like masses along a limestone-metadiorite contact. The pegmatitic minerals appear to have been produced by hydrothermal solutions originating below and working upward through limestone to the metadiorite. (I) appears to have been produced within a comparatively narrow range of conditions accompanying the formation of alkali felspar and phlogopite mica. L. S. T.

Petrologic results of a study of the minerals from the Tertiary volcanic rocks of the San Juan region, Colorado. E. S. Larsen, J. Irving, F. A. Gonyer, and E. S. Larsen 3rd. (Amer. Min., 1938, **23**, 417—429; cf. A., 1938, I, 483).—Orthoclase and related alkaline felspars are not abundant in the lavas of the San Juan region, except in the groundmass. Three chemical analyses of sanidine phenocrysts from these lavas, the alkali and CaO contents of these phenocrysts and of the rocks in which they occur, and the optical properties of the sanidines are tabulated. Various relationships are represented graphically, and the crystallisation curve of albite and orthoclase in the rocks of the San Juan mountains is given. Minor accessories, such as magnetite, ilmenite, fluorapatite, zircon, sphene, etc., are discussed. A summary of the whole investigation is included. L. S. T.

Garnet crystals in cavities in metamorphosed Triassic conglomerate in York County, Pennsylvania. G. W. Stose and J. J. Glass (Amer. Min., 1938, **23**, 430—435).—The physical and optical properties of large, well-formed crystals of andradite garnet discovered in this locality are described. L. S. T.

Composition and occurrence of garnets. W. I. Wright (Amer. Min., 1938, **23**, 436—449).—Published analyses have been surveyed in order to determine which particular garnet is characteristic of each rock type. 223 analyses are expressed in percentages of spessartite (I), grossularite (II), pyrope, almandite (III), and andradite (IV). Triangular diagrams for occurrence of different varieties of garnet in eight different rock types, *e.g.*, granites, eclogites, calcareous

rocks, etc., are given. The results show the remarkable constancy of one variety of garnet in each rock type. (I) and (III) constitute 85—90% of the mols. of garnets from pegmatites and granites, and (II) and (IV) represent >90% of the garnet mols. in calcareous contact rocks. New chemical analyses of two garnets from biotite schists from Amisk Lake, N. Saskatchewan, and from Alaska are recorded. L. S. T.

Orthopyroxenes of the Bushveld type. H. H. Hess and A. H. Phillips (Amer. Min., 1938, **23**, 450—456).—Two chemical analyses of bronzite and one of bronzitite, and the anomalous optical properties of such pyroxenes, are recorded and discussed. Orthopyroxenes from plutonic igneous rocks average 2·15% of CaO, whilst those from volcanic rocks average 2·28% of CaO, corresponding with ~9% of the diopside mol. and indicating that this represents the solubility of this mol. in Mg-rich orthopyroxenes at high temp. L. S. T.

[Metamorphic rocks of] Adelie Land, [Antartica]. D. Stewart, jun. (Amer. Min., 1938, **23**, 464—467).—The mineralogical compositions of eleven of these rocks are tabulated. L. S. T.

Geology of the Caribou stock, in the Front Range, Colorado. W. Smith (Amer. J. Sci., 1938, [v], **36**, 161—196). L. S. T.

Geochemistry and mineralogy of Polar regions. A. E. Fersman (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 619—623).—Conditions characterised by low reaction rates and liquid [H_2O] are illustrated in a review of typical minerals and geological features. I. McA.

Pegmatites at Tinton, South Dakota. F. L. Hess and B. Bryan, jun. (U.S. Bur. Mines, Rept. Invest., 1938, No. 3404, 1—19).—A preliminary report on these pegmatites, which have yielded small amounts of Sn ore. Large bodies of felspar (analysis is given of necronite—a fetid microcline) and quartz-spodumene-rock (averaging 2% Li_2O) are available. Amblygonite, mica, and some columbite are also present. L. J. S.

Analysis of a red earth and bitumen content of an argillite from Bustranje (S. Serbia). K. Schoklitsch (Zentr. Min., 1936, **A**, 171—174; Chem. Zentr., 1936, ii, 1140).—The red earth contained SiO_2 45·48, TiO_2 1·30, Al_2O_3 20·33, Fe_2O_3 10·62, FeO 0·40, MnO 0·0002, MgO 2·42, CaO 0·005, Na_2O 0·11, K_2O 5·21, H_2O+ 8·47, H_2O- 5·97, S 0·20%. The argillite contained 1·3% of bitumen. H. J. E.

Plumbocalcite from Tsumeb, and tarnowitzite. W. Siegl (Z. Krist., 1938, **99**, 95—121).—The $CaCO_3$: $PbCO_3$ ratio and mode of association in these minerals (I, II) has been studied by chemical, density, and *X*-ray analyses, confirmed by crystallographic and optical measurements. Neither is homogeneous. (I) has the dimensions and structure of calcite, cerussite and calcite (Zn, Mg, <1%) forming anomalous mixed crystals; the outer shell has a high fine-grained $PbCO_3$ content. The outer region of (II) is a member of the isomorphous aragonite–cerussite series ($PbCO_3$ ~3%) with rhombic cell elements *a* 4·97, *b* 8·015, *c* 5·79 A., ~1% > those of aragonite; excess of cerussite is neither free nor isomorphously associated. Cryst. co-orientation is discussed. I. McA.

Mineralogical nature of aluminium hydroxide in French W. African bauxites. J. de Lapparent and R. Hocart (Compt. rend., 1938, **207**, 202—203).—The deposits are described. H. J. E.

Highly persistent fluorescence in natural calcites. M. Déribéré (Compt. rend., 1938, **207**, 222—223).—A discussion of the colour and persistence of the fluorescence exhibited by various abnormal specimens. H. J. E.

Formation of bituminous sediments. K. Krejci-Graf (Schr. Gebiet Brennstoff-Geol., 1935, Pt. 10, 71—94; Chem. Zentr., 1936, ii, 2832).—Org. sea deposits usually form coals; sapropelites form bituminous coals or coal-oil shales, but with chalk bitumens and asphalts appear. No regular connexion between sea and mineral oil deposits can be traced, a more specialised nature being assumed for the latter. A. H. C.

Vegetable material as the origin of mineral oil. A. Treibs (Schr. Gebiet Brennstoff-Geol., 1935, Pt. 10, 121—148; Chem. Zentr., 1936, ii, 2831).—It is concluded that plants play a part in the formation of bitumens and mineral oils (temp. >200°). Hæmin and chlorophyll (I) derivatives are stable only in H_2O as they decay in air. Non-fatty substances, carbohydrates, and proteins may also therefore be precursors of mineral oil but must contain (I) or its degradation products. A. H. C.

Origin of mineral oil. K. Krejci-Graf (Kali, 1936, **30**, 51—108, 25 pp.; Chem. Zentr., 1936, ii, 2476).—Available deposits are not dependent on the nature of accompanying rock and an examination of existing silt deposits points to decaying deposits as the origin of mineral oils. Org. material is deposited in O_2-free H_2O with clay etc. and by drying and decomp. (*e.g.*, by freezing) may be converted into peat. The possibility of an origin as coal is excluded by the presence in oils of porphyrins and characteristic metals. Marine rather than fresh-H_2O deposits are held to account for the greater part of mineral oil. Org. material is adsorbed, H or complexes rich in H split off by bacterial action, and residual bitumen is hydrogenated to paraffins. Oxygenation yields naphthenes and heavy oils, asphalt, ozokerite, graphite, etc. A. H. C.

Origin of petroleum. E. Berl (Amer. Inst. Min. Met. Eng., Tech. Paper 920; Petrol. Tech., 1938, **1**, No. 2, 18 pp.).—The theory is developed that petroleum has been formed from plant carbohydrates which were first converted into asphalt-like "proto-products" under the influence of high pressures and moderate temp. in an alkaline medium, and were subsequently hydrogenated and cracked. Experimental evidence supporting this hypothesis is described (cf. A., 1933, 929; 1937, 1, 430). A. B. M.

Oil-field geology. V. Bilibin (Azer. Neft Choz., 1935, No. 7—8, 53—56).—A geological discussion of the Zuikha oil fields. Ch. Abs. (*e*)

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

DECEMBER, 1938.

Excitation of Balmer and Paschen series of hydrogen and deuterium by electrodeless discharge. H. NAGAOKA and T. MISHIMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 931—956).—Spectra excited by the electrodeless discharge were examined photometrically and the spark during discharge was photographed on a rapidly rotating film. Balmer series almost free of secondary spectrum were obtained to $n = 20$, and with slightly increased pressure to $n = 37$. The electron distribution function for $n = 10$ is shown diagrammatically, and $\lambda_H - \lambda_D$ for $n = 7$—20 are given. Paschen series to high terms are described and compared with spectrograms of hot stars in the infra-red. $\lambda_H - \lambda_D$ data are given. N. M. B.

Kramers' law. A correction. T. L. PAGE (Nature, 1938, **142**, 615).—Revised and extended measurements of the Paschen continuous emission of H indicate the validity of the law for at. H (cf. A., 1938, I, 543). It should not be used in calculating the absorption of the alkalis and the non-hydrogenic elements in a stellar atm. L. S. T.

Bands of H_2 ending on the $2p\,^1\Pi$ level. G. H. DIEKE (Physical Rev., 1938, [ii], **54**, 439—445).—A more complete analysis, based on new measurements, is given for the band system. Accurate vals. of the consts. are obtained, and the irregularities in the Λ-doubling and perturbations are traced to the interaction with the higher vibrational levels of $2p\,^1\Sigma$. New information is obtained about some of the states which have both electrons excited. N. M. B.

Wave-length of the new nitrogen line. J. KAPLAN (Physical Rev., 1938, [ii], **54**, 541; cf. A., 1938, I, 423).—The corr. λ is 3466·3 A. for the ^4S—^2P line. N. M. B.

Probable dissociation of nitrogen molecules in the high atmosphere. J. GAUZIT (Nature, 1938, **142**, 572—573).—The presence of an intense radiation at 3471 A. in the spectrum of the night sky has been confirmed. Dissociation of N_2 mols. in the high atm. can now be accepted. L. S. T.

Some aspects of nitrogen afterglows. D. B. MCNEILL and K. F. HARVEY (Phil. Mag., 1938, [vii], **26**, 502—506).—Attempts to produce strong sources of Vegard–Kaplan intercombination bands in active N and N afterglows by various methods failed but the appearances of the various discharges obtained are described, together with observations on the properties of the Lewis–Rayleigh afterglow. The discharges used were: N_2–A mixtures excited by electron beams; N_2 excited by high-frequency discharge; auroral afterglows in N_2 excited by intermittent discharge; Lewis–Rayleigh afterglow excited by condenser discharge. T. H. G.

Atomic lines in the auroral spectrum. L. VEGARD (Nature, 1938, **142**, 670).—Approx. 20 auroral lines can be referred to atoms of O and N in the neutral or ionised state; 10 of these coincide with nebular lines. Forbidden lines from the at. ground states probably present in the auroral luminescence are listed. Physical conditions in the auroral region are such that lines corresponding with forbidden transitions from the metastable ground states of O I, O II, O III, and N I and N II appear in the auroral spectrum. L. S. T.

Generation of auroras by means of radio waves. V. A. BAILEY (Nature, 1938, **142**, 613—614).—The possibility of generating artificial auroras by means of powerful radio stations is discussed. L. S. T.

Pressure effect in the magnesium hydride band at 2590 A. A. GUNTSCH (Z. Physik, 1938, **110**, 549—552).—The emission band at 2590 A. from the high-pressure arc (H_2 at 3 atm.) is photographed. The band appears only at pressures above 400 mm. Twice the no. of lines are observed in emission as in absorption. L. G. G.

Spectral continua of the rare gases. S. P. MCCALLUM (Nature, 1938, **142**, 614).—Photographs of the spectra of the light emitted from the positive column in a tube 3 cm. in diameter in A, Kr, and Hg over the range 7200—2200 A. show that these gases have the same long-wave spectral limit at ~6850 A. The theory suggested for the well-known H continua, that the radiation is emitted by a mol. consisting of an excited and a neutral atom, provides an explanation of the phenomena in the rare gases. L. S. T.

Hyperfine structure interval rule in indium. D. H. TOMBOULIAN and R. F. BACHER (Physical Rev., 1938, [ii], **54**, 446—447; cf. A., 1938, I, 2).—Interferometric measurements on λ 7182 ($5s6p\,^1P_1 \rightarrow 5s6s\,^3S_1$) and λ 7276 ($5s6p\,^3P_0 \rightarrow 5s6s\,^3S_1$) of In II indicate that the separations of the state $5s6s\,^3S_1$ follow the interval rule to within ~0·05%. Perturbations by neighbouring states are negligible and there are no effects for this state due to the known electric quadrupole moment of the nucleus. Results indicate that the assumption of a nuclear magnetic moment successfully accounts for the observed relative separations. N. M. B.

Measurement of energy distribution in a spectrum consisting of lines and a continuum. F. RÖSSLER (Z. Physik, 1938, **110**, 495—501).—With a source emitting a line spectrum and a strong con-

tinuous background, the relative proportions of energy entering the spectrograph from the line spectrum and from the continuum at a given λ vary with the slit width. A simple method is given for direct evaluation of this ratio. H. C. G.

Effect of collisions on the intensities of nebular lines. D. H. MENZEL (Nature, 1938, **142**, 644).—The predominance of the forbidden lines in nebular spectra is attributable not to the effect of collisions in de-exciting an atom before it can radiate, but to the weakness of the permitted lines. L. S. T.

Gas-ionising radiation from a spark discharge. H. RAETHER (Z. Physik, 1938, **110**, 611—624).—Short-wave radiation (800 to 1000 A.) from a spark discharge is shown to liberate photo-electrons from air, H_2, and O_2 in a cloud chamber and absorption coeffs. for the radiation at 760 mm. pressure are approx. 2, 0·8, and 5 cm.$^{-1}$, respectively. The conductivity of the ionosphere would be increased by the presence of this radiation in sunlight. H. C. G.

Detection of solar radiation of wave-length about 2150 A. K. O. KIEPENHEUER (Naturwiss., 1938, **26**, 678—679).—Experiments on the Jungfrau (3457 m. above sea-level) indicate that solar radiation of 2150 A. must there be weaker than 5×10^6 quanta per cm.^{2} sec. Repetition of the experiments on the Sphinx peak (3570 m.) indicates a weak effect at 2150 A. The intensity of the radiation varies considerably, the effect being approx. parallel to the variation of the intensity of radiation of λ 2900. Absorption by O_3 (above a height of 25 km.) is probably responsible for the small intensity at 2150 A. A. J. M.

Evaluation of the "r" unit, and the accuracy and constancy of standard apparatus. H. KÜSTNER (Physikal. Z., 1938, **39**, 743—761).—A review dealing with the determination of the international Röntgen unit, r. A. J. M.

Azimuthal intensity distribution of Röntgen retardation radiation. K. BÖHM (Ann. Physik, 1938, [v], **33**, 315—334).—Measurements have been made using as anticathode a Mg film <0·1 μ. thick mounted on celluloid. Results agree with those of Kulenkampff (A., 1929, 14) and with the theory of Sommerfeld. O. D. S.

Effect of wall material on the determination of ionisation by *X*-rays with a chamber, and a new type of chamber. H. HASE and H. KÜSTNER (Physikal. Z., 1938, **39**, 737—742).—The effect of the material of the wall (graphitised Cellophane, Al, Cu, Pb, brass) on the ionisation by *X*-rays of air in a chamber was determined with rays of different hardness. The ionisation is the greater the more dense is the wall material and the smaller the diameter of the chamber. The results of this investigation are used in the construction of a new chamber in which the ionisation is independent of the hardness of the rays. A. J. M.

Influence of cadmium vapour on the sparking discharge potential in argon. I. KESAEV (Tech. Phys. U.S.S.R., 1937, **4**, 68—72).—The sparking potential (V) of A–Cd vapour mixtures has been measured between 0° and 350°. After prolonged purification of the discharge tube by a glow discharge, reproducible results were obtained indicating that V is approx. const. between 0° and 200° and then falls to a min. at 325°, corresponding with 0·5% Cd in the mixture. F. J. L.

Striking potential of the high-frequency discharge in hydrogen as conditioned by frequency. S. GITHENS, jun. (Physical Rev., 1937, [ii], **51**, 688).—The curves obtained for H_2 and brass electrodes show the existence of a crit. spark length for the high-frequency discharge. This length decreases with an increase in frequency. L. S. T.

Abnormal cathode fall of the glow discharge. M. J. DRUYVESTEYN (Physica, 1938, **5**, 875—881).—The cathode fall observed in He, Ne, A, Kr, and Xe is not in accord with the theory of von Engel and Steenbeck. Possible causes of some of the deviations are discussed. J. W. S.

Photo-electric properties of alkali metal films of atomic thickness on supporting metals of high work function. II. Cæsium and potassium on tungsten and platinum. H. MAYER (Ann. Physik, 1938, [v], **33**, 419—444; cf. A., 1938, I, 119; 1937, I, 337).—The work function of pure gas-free Cs in a thick layer is 1·94 v. O. D. S.

Energy states of valency electrons in some metals. I. (9) Selectivity of photo-electron transition in zinc, and the selection rule, $\Delta l = \pm 1$. M. SATO (Sci. Rep. Tôhoku, 1938, [i], **27**, 137—154; cf. A., 1938, I, 167).—The selectivity of photo-electron transitions in the surface of a Zn crystal is related with the direction of the oscillating electric vector of the exciting light. Application of data obtained from the electrode potentials of the surfaces of Zn single crystals leads to an explanation of the selection rule, $\Delta l = \pm 1$, based on the fact that the stability of orbital motion of the electron depends on the mutual orientation of the orbital plane and the electric vector of the exciting light. This means that the orbital planes of p and d electrons in the energy levels E_2 and E_3 in the surface layer of a Zn crystal are perpendicular and parallel respectively to the axis [0001] of the crystal. W. R. A.

Secondary electron emission of beryllium. R. KOLLATH (Ann. Physik, 1938, [v], **33**, 285—299; cf. A., 1938, I, 124).—The secondary electron emission of vac.-deposited films of Be is ≪ that of compact Be plates. The emission of the films is increased slightly by oxidation in an O_2 glow discharge and becomes equal to that of compact Be on prolonged heating at 350° in O_2. On heating in vac. the emission increases to the val. for compact Be between 700° and 800°. O. D. S.

Measurements of secondary electrons liberated at reflecting gauzes. M. SANDHAGEN (Z. Physik, 1938, **110**, 553—572).—The yield and distribution of secondary electrons liberated by impact of primary electrons on fine-mesh gauzes of various metals (Al, Ni, Ag, and steel), under various conditions, have been investigated. Results are discussed in relation to the electron multiplier. H. C. G.

Temperature scale and thermionic emission from rhodium. H. B. WAHLIN and L. V. WHITNEY

(J. Chem. Physics, 1938, 6, 594—597).—When Rh is heated to incandescence in air or O_2 a transition temp. is reached; subsequent heating or cooling is marked by an abrupt change in the emissivity. *X*-Ray pictures of the high- and low-emissivity surfaces show no cryst. differences in the metal. Prolonged out-gassing, however, affects the crit. temp. This indicates a surface layer on the Rh, either an activated adsorption of O_2 or an oxide of Rh, and this idea is confirmed by the disappearance of the effect in high vac. (2×10^{-8} mm.). The temp. and partial pressure of O_2 at which the coating disappears are related by the Clausius–Clapeyron equation. The electronic work function of a clean Rh surface has been computed. W. R. A.

Construction of filament surfaces. R. P. JOHNSON (Physical Rev., 1938, [ii], 54, 459—467).—An incandescent W filament gradually loses its die marks and displays a surface with structure depending on running conditions. Filaments heated in vac. with a.c. remain smooth and nearly round. In neutral gas, with a.c., the filament tends to expose smooth concave (100) faces. The d.c. vac. structure is steplike, is polarised with respect to the current, and seems to be due to a drift of W ions in the field along the filament. Surface migration of Th adsorbed on W, during d.c. heating, was shown in a simple electron-optical tube. Where a temp. gradient exists, a.c. structure identical with d.c. structure appears on filaments, and is directly due to surface diffusion in the temp. gradient. On d.c. gas filaments the d.c. structure and the gas structure are concurrent. Investigations indicate that Ta, Mo, Pt, Fe, and Ni filaments in vac. develop a roughened surface on d.c. heating but remain smooth on a.c. N. M. B.

Electron microscope studies of thoriated tungsten. A. J. AHEARN and J. A. BECKER (Physical Rev., 1938, [ii], 54, 448—458).—An electron microscope for obtaining electron images of thoriated W ribbons is described. The active and inactive patches composing an electron image agree in size, shape, and no. with the exposed W grains. The Th comes to the surface in eruptions at a relatively small no. of randomly located points. During thoriation the change in relative emission from different grains is in many cases so great that the relative emissions are reversed. Work function differences between grains range up to 0·6 v. Differences in behaviour of a single-crystal filament and a polycryst. ribbon are described. N. M. B.

Visible radiation of pure liquids due to the effect of rapid electrons. P. A. TSCHERENKOV, I. M. FRANK, and I. E. TAMM (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 29—31).—When rapid electrons (*e.g.*, Compton electrons from γ-rays, or β-rays) are passed through a liquid a faint visible radiation is emitted which has been investigated by the quenching method. When γ-rays are used the intensity of the emitted radiation is independent of the physico-chemical properties of the liquid, but when β-rays are used the intensity is inversely $\propto d$ of liquid. The visible radiation is unaffected by changes in η of the liquid or by the addition of KI or $AgNO_3$. It is partly polarised, the degree of polarisation being independent of η. The spectrum is continuous. The max. intensity of radiation is inclined to the direction of the electron beam, the angle depending on n. For H_2O the angle is 28°. A. J. M.

Tscherenkov radiation. G. B. COLLINS and V. G. REILING (Physical Rev., 1938, [ii], 54, 499—503; cf. A., 1937, I, 546).—The radiation, produced when electrons traverse a medium with a velocity > that of light in the medium, was investigated with 2×10^6-v. electrons from an electrostatic generator. For glass, mica, Cellophane, willemite, H_2O, EtOH, and C_6H_6 the direction of emission is given by $\cos 0 = 1/\beta n$, where β is the velocity ratio. There is a sharp intensity max. The radiation in each case was continuous and identical in appearance, and extends with increasing intensity from the infra-red to the ultra-violet absorption limit of the medium. Approx. quant. intensity measurements indicate that one $1·9 \times 10^6$-v. electron brought to rest in H_2O produces 40 quanta in a λ range 4000—6700 A. Results are in agreement with theory (cf. Frank, A., 1937, I, 220). N. M. B.

Emission of radiation by electrons of energy about $2·0 \times 10^6$ e.v. E. WILLIAMS (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 71—73).—The production of secondary γ-rays on the passage of γ-rays through matter is considered. These can arise from the Compton scattering of primary radiation, annihilation radiation from positive electrons produced by the primary radiation, and the retardation radiation emitted by Compton and pair electrons. The val. of the last relative to the other two has been determined for γ-rays of $2·62 \times 10^6$ e.v. energy from Th-*C''*. The retardation radiation is $\sim h\nu = 0·5$ to $1·5 \times 10^6$ e.v., *i.e.*, considerably > theoretical. A. J. M

Inelastic scattering of slow electrons from a silver single crystal. J. C. TURNBULL and H. E. FARNSWORTH (Physical Rev., 1938, [ii], 54, 509—514).—The energy distribution of electrons inelastically scattered from a (111) face of a Ag single crystal was investigated by the magnetic deflexion method. Results are plotted and discussed. N. M. B.

Electron-optics. M. COTTE (Ann. Physique, 1938, [xi], 10, 333—405).—Mathematical. N. M. B.

Scattering of rapid electrons by nuclei. E. G. STEPANOVA (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 91—98).—The scattering of rapid β-rays from Ra-*C* by N_2 and A was investigated by the Wilson cloud-chamber method, the velocities ranging from 200 to 1000 e.kv. and 1500 to 3000 e.kv. The single scattering observed in N_2 was considerably > the vals. obtained by calculation from Mott's wave-mechanics formula. In A the scattering was also > the calc. val., but the deviation was not so marked as with N_2. With slower β-rays results agree more closely with theory. A. J. M.

Range of high-speed electrons. A. BRAMLEY (Physical Rev., 1937, [ii], 51, 682).—Theoretical. L. S. T.

Angular distribution of electron pairs. J. C. JAEGER and H. R. HULME (Nature, 1938, 142, 573).—Theoretical. L. S. T.

Determination of the electronic charge, and the viscosity of air. G. B. BANERJEA and B. PLATTANAIK (Z. Physik, 1938, **110**, 676—687; cf. A., 1938, I, 393).—A full description of work, the results of which are already noted. L. G. G.

(A) Carrier mobility of liquids electrified by bubbling. (B) Interpretation. S. CHAPMAN (Physical Rev., 1938, [ii], **54**, 520—527, 528—533; cf. A., 1937, I, 498).—(A) The mobility spectra produced by bubbling H_2O and various aq. solutions of salt, acid, base, sugar, and soap were investigated with an Eriskon mobility tube under high resolving power. Current–mobility curves show, for H_2O, two positive and five negative groups of carriers of mobilities 1·80—0·20 cm. per sec. per v. per cm. The ratio of the total amount of positive to negative electrification decreases as the size of the bubbling capillary increases. Addition of salts to H_2O favours production of slow carriers at the expense of fast ones. Medium concns. (10^{-3}M.) produce more total electrification than distilled H_2O, and high concns. (1M.) less. With the addition of sugar to H_2O, several groups of large nos. of carriers of various mobilities appear, and the total electrification increases to about 12 times that for H_2O. Air blasts of high humidity favour production of slow carriers and give heterogeneous spreads of mobilities.

(B) The groups of negative carriers of mobility 1·8, on bubbling distilled H_2O, may be interpreted as normal negative ions in moist air; the positive and negative groups at 1·0 and −0·95 are probably due to carriers containing an extra H^+ and OH^- ion, respectively. The other H_2O groups appear to be formed partly by the breaking of the thin bubble film and partly by the evaporation of larger carriers. Increasing concn. of electrolytic ions causes the main max. to shift to lower mobilities, *i.e.*, larger drop sizes. Sucrose in the bubble film appears to provide nuclei and formation of a greater no. of droplets. For more violent bubbling the films are torn into thick fragments so that the positive charges are more frequently torn off, increasing the proportion of positive charge. Supersaturated air blasts inhibit evaporation so that only a wide distribution of carriers of all sizes is observed. N. M. B.

Statistical theory of α-decay. J. J. FRENKEL (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 233—248).—The analogy between evaporation of solids or liquids and radioactive decay of excited nuclei holds where the excitation energy is high and the velocity of the emitted particles is large. The probability of disintegration can be calc. from the probability of the reverse process of the capture of the α-particle by the nucleus produced. The classical kinetic theory of the evaporation of NaCl made up of a Na^+ and a Cl' from a crystal lattice which bears on the emission of an α-particle made up of protons and neutrons is discussed, and applied to the disintegration of a complex nucleus. The disintegration of highly complex excited nuclei is also discussed on the basis of "internal temp:" as defined by the mean val. of the excitation energy. A. J. M.

Resonance in the (n, α) transition of neon. K. GAILER (Z. Physik, 1938, **110**, 605—610).—The $^{20}_{10}Ne$ (n, α) $^{17}_{8}O$ and the $^{22}_{10}Ne$ (n, α) $^{19}_{8}O$ transitions are studied with fast neutrons of continuous energy distribution. The measured total energies (α-particle and final nucleus) lie in groups which correspond with the excitation states of the intermediate nuclei $^{21}_{10}Ne$ and $^{23}_{10}Ne$. L. G. G.

Deferred re-emission of α-particles absorbed by light nuclei. F. PERRIN (Nuovo Cim., 1938, **15**, 189—192).—The experiments of Pavlovski (A., 1932, 555) on the wide-angle scattering of α-particles by light nuclei suggest that an α-particle may be re-emitted after about 10^{-13} sec., leaving the nucleus in its original state. O. J. W.

Disintegrations of very heavy nuclei by deuterons. H. A. BETHE (Physical Rev., 1937, [ii], **51**, 1004).—Probable primary processes, viz., the emission of a neutron and a proton, are discussed. L. S. T.

Evaporation model of nuclear disintegrations. E. J. KONOPINSKI and H. A. BETHE (Physical Rev., 1937, [ii], **51**, 1004). L. S. T.

Disintegration constant of thorium and the branching ratio of thorium-*C*. A. F. KOVARIK and N. I. ADAMS, jun. (Physical Rev., 1938, [ii], **54**, 413—421).—The disintegration const. of Th was determined by the method of counting α-particles with special checks on counting, using ThO_2 prepared from the thorite used by Geiger, with correction for Io present. The half-val. period obtained was $1·39 \times 10^{10}$ years, compared with the Geiger–Rutherford val. $1·3 \times 10^{10}$ and the international val. $1·8 \times 10^{10}$ years. The branching ratio, Th-*C'* to Th-*C* + *C'*, is 0·663. N. M. B.

Positron spectrum of an active thorium deposit. A. I. ALICHANOV and V. P. DŽELEPOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 113—114).—A repetition of the measurements of Alichanov *et al.* (J. Phys., 1936, **7**, 163), using a stronger source and improved apparatus. Besides the sharp break at an energy val. of 1600 e.kv., six new smaller, but well defined, discontinuities are observed. The active Th deposit emits γ-rays of energies 1350±20, 1500±20, 1600±20, 1800±20, 2200±20, 2620, and 3200±40 e.kv. Only 84% of all the positrons from the active Th are due to the line 2620 e.kv. and only two thirds of all hard quanta (*i.e.*, >1000 e.kv.) have an energy 2620 e.kv. The whole positron spectrum of the deposit can be explained by the inner conversion of γ-rays on the negative energy levels. With the aid of the analysis of the long-range groups of α-particles, the energy levels of Th-*D* and Th-*C'* can be constructed, the former confirming the results of Ellis and Mott (A., 1933, 204). Support for these energy level schemes is found in the β-spectrum of Th-*B* + -*C* + -*C''*. T. H. G.

Abnormal phenomena accompanying the absorption of rapid β-rays. D. V. SKOBELTZYN (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 75—90).—Examination of the tracks of rapid β-rays in N_2 by the Wilson method indicates anomalies in the region of speeds of 1000—3000 e.kv. The abnormal diffusion formerly detected (A., 1936, 402) has been confirmed. The sudden loss of almost all the energy of a rapid

β-particle on collision has been observed, the end of the range being marked by small branches due to abnormal δ-rays, of which the directions are distributed uniformly. A. J. M.

Positron spectrum emitted by lead on irradiation with thorium-*C*″ γ-rays. A. I. ALICHANOV and V. P. DŽELEPOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 115—116).—The source was in a graphite thimble covered with Pb foil, the spectrum in which was found by subtracting the spectrum of the graphite from that of the whole, and then deducting the part of the positrons produced by γ-rays of energy 2200 e.kv., which are the most powerful γ-rays found from an active Th deposit. The results are in good agreement with the theoretical calculations of Eggert and Holm. T. H. G.

Production and properties of neutrons. N. FEATHER (Sci. Progr., 1938, **33**, 240—256).—A review.

Interaction of slow neutrons with gases. H. CARROLL and J. R. DUNNING (Physical Rev., 1938, [ii], **54**, 541; cf. A., 1938, I, 548).—Data are reported for the variation in cross-section of a series containing increasing nos. of protons: H_2, CH_4, C_2H_6, C_3H_8, C_4H_{10}, and a paraffin $\sim C_{22}H_{46}$ interacting with ~300° K. neutrons, and for slow neutrons interacting with gas nuclei (He, Ne, A, N_2, and O_2). The variations in cross-section in the paraffin series are closely ∝ the square of the reduced mass. N. M. B.

Scattering and absorption of photo-neutrons. A. I. LEIPUNSKI, D. V. TIMOSCHUK, and E. FEDOROV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 173—176).—The limit of the nuclear photo-effect for Be (1·6 Me.v.) and the spectrum of γ-rays of Ra in equilibrium with the disintegration products show that photo-neutrons from Be + γ-Ra have an energy of about 150 ke.v. The length of the free path of photo-neutrons in paraffin is in agreement with Fermi's theory. There is a steady increase in scattering cross-section for heavy elements with increasing at. wt. With light elements, however, the cross-section varies considerably from one nucleus to another, showing the existence in light nuclei of levels with an energy ~100 e.kv. No inelastic collisions of primary photo-neutrons were observed. The upper limit of the absorption cross-section is $<4 \times 10^{-25}$ sq. cm. A. J. M.

Angular distribution of protons in collisions with rapid neutrons. N. A. DOBROTIN (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 199—204).—Results of the investigation of the collisions of neutrons with protons are in favour of a symmetrical distribution of particles. A. J. M.

Depolarisation by neutron proton scattering. J. SCHWINGER and I. I. RABI (Physical Rev., 1937, [ii], **51**, 1003—1004).—Theoretical. L. S. T.

Action of thermal neutrons on aluminium. P. WANG (Z. Physik, 1938, **110**, 502—511).—Irradiation of Al with Ra–Be neutrons slowed up by means of paraffin shows that the production of $^{28}_{13}$Al of half-life period 2·3 min. is due to *C*-neutrons. From absorption measurements in Al with Al as indicator, the absorption coeff. $k = 0{\cdot}037$ cm.^{2} per g., corresponding with an action cross-section of $1{\cdot}6 \times 10^{-24}$ cm.^{2} L. G. G.

Neutrons and the origin of life. J. TANDBERG (Nature, 1938, **142**, 572).—Complicated org. mols. containing C and N, for example, may have originated as a result of nuclear reactions and may have influenced the evolution of org. matter, eventually leading to the first primitive forms of living matter, no longer in existence. L. S. T.

Primary energies composing the electron and their interpretations. Matter, gravitation, and life. A. DE MAYOLO (Congr. Nat. Chim. Pérou, July, 1938, 28 pp.). F. R. G.

Formation of light artificial radio-elements by neutron bombardment. N. N. DMITRIEV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 191—197).—The formation of light radio-nuclei by neutron bombardment accompanied by the emission of α-particles and protons was investigated using a Wilson low-pressure chamber. Heavy particles were found to be emitted under these conditions from Mg, Al, S, and Fe. α-Particles emitted from Al in the formation of radio-Na have small energy. A. J. M.

Radio-elements formed when uranium is bombarded by neutrons. (MME.) I. CURIE and P. SAVITCH (J. Phys. Radium, 1938, [vii], **9**, 355—359).—A detailed account of work already noted (A., 1938, I, 381). W. R. A.

Transmutation of (A) titanium, (B) scandium, by thorium-*C*′ α-particles. (A) W. L. DAVIDSON, jun., and E. POLLARD. (B) E. POLLARD (Physical Rev., 1938, [ii], **54**, 408—410, 411—412).—(A) The bombardment reaction is probably $^{48}Ti + {}^4He \rightarrow {}^{51}V + {}^1H$, giving three groups of protons corresponding with nuclear energy changes 1·10, 0·00, and −3·63 Me.v. With Dempster's mass val. 47·9651 for ^{48}Ti (cf. A., 1938, I, 111), the mass val. 50·9598 for ^{51}V is obtained.

(B) The observed bombardment reaction is $^{45}Sc + {}^4He \rightarrow {}^{48}Ti + {}^1H$, giving three groups of protons corresponding with nuclear energy changes −0·3, −1·4, and −2·6 Me.v. The calc. mass val. of ^{45}Sc is 44·9599. N. M. B.

[Half-life] period and absorption of the β-rays from the radioactive element $^{32}_{15}$P. P. C. CAPRON (Physica, 1938, **5**, 882—888).—By means of a Geiger β-ray counter the half-life period of $^{32}_{15}$P has been determined as 14·5±0·3 days. The max. energy of the electrons, as determined by filtration through Al, is 1·68±0·05 Me.v. J. W. S.

Relationship between the transitions of fluorine by α-particles. N. K. SAHA (Z. Physik, 1938, **110**, 473—494).—The resonance levels for the three processes $^{19}_9F + \alpha \rightarrow (^{23}_{11}Na) \rightarrow$ (1) $^{22}_{11}Na + p$; → (2) $^{22}_{11}Na + n$; → (3) $^{19}_9F + \alpha + \gamma$ are measured, using Po α-radiation energy controlled by an intervening layer of CO_2 and a CaF_2 layer as source of F. Coincidence of the resonance energies for the three processes is only partial, but indicates that γ-ray production occurs with both α, *n* and α, *p* transitions. The ratio of the transition probabilities for proton and neutron production depends on the state of excitation

of the intermediate nucleus. The abs. yield for the α, n process is $< 4{\cdot}0 \times 10^{-6}$, and is of similar magnitude to that for the α, p process. In addition the half-life period of ^{43}Sc is 4·4 hr. and the long-lived radioactivity of ^{22}Na is confirmed. L. G. G.

γ-Rays from fluorine due to proton bombardment. E. J. BERNET, R. G. HERB, and D. B. PARKINSON (Physical Rev., 1938, [ii], **54**, 398—408; cf. A., 1937, I, 339).—A detailed study of the resonance excitation of γ-rays from F when bombarded by high-speed 0·18—2·2 Me.v. protons is reported. Improved technique has enabled narrower resonance peaks and new resonances to be obtained. Widths and positions of the 7 best-defined peaks are given. N. M. B.

γ-Rays from Li + ^{1}H. W. R. KANNE and G. L. RAGAN (Physical Rev., 1938, [ii], **54**, 480—481).—The γ-ray and α-particle excitation curve shows a smooth rise with no indication of a resonance. N. M. B.

Internal conversion of γ-rays in element 43. D. C. KALBFELL (Physical Rev., 1938, [ii], **54**, 543).—Radioactive 43, examined in a magnetic spectrograph, shows three internally converted γ-rays. The 6-hr. period gives two lines due to internal conversion in the K and L shells; the γ-ray energy is 129 ke.v. The long-lived isotopes of 43 formed directly by deuteron bombardment of Mo gave lines corresponding with 87- and 184-ke.v. γ-rays. N. M. B.

Nuclear isomerism and internal conversion. B. PONTECORVO (Physical Rev., 1938, [ii], **54**, 542).—In order to detect the γ-ray transition to the ground state in nuclear isomerism a line spectrum of conversion electrons from one of the isomeric forms of ^{105}Rh formed from Rh by slow neutron capture was sought. The observed soft component is attributed to conversion electrons from a γ-ray. N. M. B.

Radioactive isotopes from aluminium. M. L. POOL and J. M. CORK (Physical Rev., 1937, [ii], **51**, 383).—Al bombarded by high-energy deuterons yields radioactive isotopes other than $^{28}_{13}$Al. Chemical separations of very pure Al activated by 6·5-Me.v. deuterons show an additional activity in the Mg ppt. which emits positives only and has a half-life of 15·8 hr. This may indicate the formation of $^{23}_{12}$Mg. L. S. T.

Location of resonances in boron + proton reactions. B. WALDMAN, R. C. WADDEL, D. CALLIHAN, and W. A. SCHNEIDER (Physical Rev., 1938, [ii], **54**, 543; cf. Oppenheimer, A., 1938, I, 290).—The α-particle and γ-ray yields from the reactions $^{11}_5B + ^1_1H \rightarrow ^8_4Be + ^4_2He$ and $^{11}_5B + ^1_1H \rightarrow ^{12}_6C + \gamma$, measured simultaneously with protons of energies up to 200 ke.v. and thick B targets, show α-particle and γ-ray resonances coinciding to within 1 ke.v. and occurring at 165±4 ke.v. (cf. Gentner, A., 1937, I, 108). N. M. B.

Radioactive manganese isotopes. J. J. LIVINGOOD and G. T. SEABORG (Physical Rev., 1938, [ii], **54**, 391—397).—Reactions and radioactive decay periods of Mn, with emission products in parentheses, when Co, Fe, Mn, Cr, and V were bombarded with neutrons, deuterons, and α-particles are: ^{50}Cr (d, n) ^{51}Mn, 46±2 min. (positrons); ^{54}Fe (d, α) ^{52}Mn, 21±2 min. and 6·5±1 days (positrons): ^{56}Fe (d, α) ^{54}Mn, ^{53}Cr (d, n) ^{54}Mn, ^{51}V (α, n) ^{54}Mn, 310±20 days (k electron capture). The following all gave ^{56}Mn, 2·59±0·02 hr. (electrons): ^{55}Mn (n, γ), ^{55}Mn (d, p), ^{53}Cr (α, p), ^{58}Fe (d, α) ^{56}Fe (n, p), and ^{59}Co (n, α). No evidence was found for radioactive ^{53}Mn. N. M. B.

Radioactivity produced in yttrium, zirconium, and molybdenum. R. SAGANE, S. KOJIMA, G. MIYAMOTO, and M. IKAWA (Physical Rev., 1938, [ii], **54**, 542—543).—A preliminary summary of observed periods and provisional assignments is tabulated. N. M. B.

Capture of orbital electrons by nuclei. L. W. ALVAREZ (Physical Rev., 1938, [ii], **54**, 486—497).—A simple theory of electron capture is outlined and three general methods for its detection are suggested. The first experimental evidence for the process (in activated Ti) is described. A rigorous experimental proof of the hypothesis is given for the case of ^{67}Ga. The properties of ^{67}Ga are described in detail, and the first evidence for internal conversion in artificially radioactive atoms is given. A summary of isotopes (^{180}Ta, ^{40}K, ^{65}Zn, ^{197}Hg, ^{106}Ag, ^{107}Cd or ^{109}Cd, ^{7}Be, and ^{54}Mn) with properties best explained on the hypothesis is presented. N. M. B.

Wilson photographs of heavy electrons. H. MAIER-LEIBNITZ (Naturwiss., 1938, **26**, 677—678).—Heavy positrons have been detected in C_3H_8 by means of a Wilson chamber. The mass of the particles was that of 120±30 electrons, and in another case that of 30 electrons. It is probable that the particles have no standard mass. At the end of the range no positrons were visible. This may be due to a slow heavy positron attaching itself to an electron and breaking down into γ-rays and neutrino rays. It is also possible for a heavy neutrino to be formed. "Radioactive" disintegration of heavy positrons is observed in the photographs, the decomp. giving rise to a heavy uncharged particle, a light positron, and a neutrino. A. J. M.

Fluctuations in radiative energy loss and range of fast particles. W. H. FURRY (Physical Rev., 1937, [ii], **51**, 1004). L. S. T.

Photographic tracks from cosmic rays. M. BLAU (Nature, 1938, **142**, 613).—New groups of short-range tracks, observed on photographic plates covered with paper and pure paraffin wax, and exposed to cosmic rays at an altitude of 3400 m., may be due to slow-moving particles arising from disintegration processes of the atoms in the emulsion. This disintegration may be the result of a secondary radiation produced in the paraffin by the cosmic rays. L. S. T.

Further measurements on ultra-radiation showers. K. SCHMEISER (Z. Physik, 1938, **110**, 443—449).—The absorption curve of showers of hard radiation of small angle divergence is shown to be independent of the nature of the radiators; the intensity of the shower ∝ the at. no. of the source and absorption of the shower ∝ the mass per sq. cm. of the absorber. The phenomenon of additional radiation from the absorber appears to be the further liberation

of softer radiation through impact of the hard shower particles. H. C. G.

Production of Hoffmann collisions through multiplication. H. EULER (Z. Physik, 1938, **110**, 450—472).—The no. of particles produced in cascade by electrons originating in outer space and the frequency of collisions are discussed in relation to the thickness of matter (air, Pb, Fe, and Al) traversed. H. C. G.

Automatically recorded coincidence counter measurements of the cosmic-ray latitude effect. D. N. READ and T. H. JOHNSON (Physical Rev., 1937, [ii], **51**, 386). L. S. T.

Influence of the earth's magnetic field on cosmic-ray intensities up to the top of the atmosphere. I. S. BOWEN, R. A. MILLIKAN, and H. V. NEHER (Physical Rev., 1937, [ii], **51**, 1005).—The law of absorption of electrons going through the atm. in two different ranges of energy, viz., from 2·5 to 5×10^3 Me.v. and from 6 to 17×10^3 Me.v., has been determined experimentally. It is similar to the Carlson–Oppenheimer extension (A., 1937, I, 213) of the Bethe–Heitler law. L. S. T.

Production and absorption of cosmic-ray showers. L. FUSSELL, jun. (Physical Rev., 1937, [ii], **51**, 1005—1006).—Cosmic-ray shower photographs taken when 3 Pb scattering plates are used show that most showers develop and multiply in several successive steps. In very thin plates pairs are frequently created, but the formation of larger groups has not been observed. Complex showers develop at a single point only in rare cases. The results support the radiation, pair-formation theory of showers (A., 1937, I, 213). L. S. T.

Two groups in cosmic rays. P. AUGER (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 103—117).—The properties of the hard and soft groups of rays in cosmic radiation have been investigated with reference to production of showers, penetrating power, and angular distribution. Investigation of showers confirms the view that the soft group is made up of electrons accompanied by photons, and that the hard group is composed of more massive particles, probably protons. A. J. M.

Nature of extensive cosmic-ray showers. L. JÁNOSSY and A. C. B. LOVELL (Nature, 1938, **142**, 716—717).—Cloud-chamber photographs of showers that extend over several sq. m. have been obtained. There is no indication of particles other than electrons, and if penetrating particles are present they form only a small fraction of the shower particles. The total energy of certain showers may be $> 10^{16}$ e.v. L. S. T.

Study of large cosmic showers at an altitude of 2800 metres. P. AUGER and R. MAZE (Compt. rend., 1938, **207**, 671—674; cf. A., 1938, I, 428, 490).—The angular distribution and penetrating power of the particles have been studied, using coincidence counters in conjunction with Pb screens. At this altitude the showers contain $>10^4$ particles (25—50 per sq. m.), consisting of electrons, high-energy photons, and penetrating corpuscles; they originate >1000 m. above the apparatus. The total energy indicates that the showers are produced by primary particles of energy $>10^{13}$ e.v. A. J. E. W.

Absolute intensity of cosmic radiation at sea-level. J. CLAY and P. H. CLAY (Physica, 1938, **5**, 898—900; cf. A., 1938, I, 549).—Using an ionisation chamber filled with A at 61 atm., the intensity of cosmic radiation has been measured on a Norwegian fjord at 58° N. latitude and, with shielding from radioactive influences, also at Amsterdam. It is inferred that the val. at sea-level for magnetic latitudes >50° is $2{\cdot}24 \pm 0{\cdot}06$ I in A, and $1{\cdot}56 \pm 0{\cdot}05$ I in air, both at 770 mm. and 15°. J. W. S.

Specific ionisation characteristics of cosmic rays. S. SZCZENIOWSKI, S. ZIEMECKI, and K. NARKIEWICZ-JODKO (Bull. Acad. Polonaise, 1938, **A**, 273—289).—The ionisation of N_2 and Kr by γ- and cosmic rays has been measured in the upper layers of the troposphere by an apparatus which is described. The ionisation by cosmic rays $\propto$ the gas density, in contrast to the predictions of Juilfs (cf. A., 1938, I, 3). The ratio of the ionisation currents I_{Kr}/I_{N_2} is 3·17 for cosmic rays and 5·5 for γ-rays. This difference is explained by consideration of the different natures of the radiations. The difference between the observed and theoretical vals. for I_{Kr}/I_{N_2} in the case of cosmic rays is due to the different vals. of the mean energy of creation of a pair of ions in Kr and N_2. W. R. A.

Absorption of the shower-producing component of cosmic radiation in iron and lead. J. CRUDUP (Physical Rev., 1938, [ii], **54**, 483—486).—Measurements of the absorption coeff. of the shower-producing component give the vals. 0·076 in Fe and 0·35 cm.$^{-1}$ in Pb (cf. Woodward, A., 1936, 774). The corresponding at. absorption coeffs. are nearly $\propto Z^2$ of the absorber. N. M. B.

Penetrating corpuscular component of the cosmic radiation. J. C. STREET and E. C. STEVENSON (Physical Rev., 1937, [ii], **51**, 1005).—Experiments with the penetrating rays traversing various thicknesses of Pb in a vertical column show that these particles cannot be described as electrons obeying the Heitler theory of radiation and pair formation, nor can an appreciable fraction be protons. L. S. T.

Loss of energy of penetrating cosmic radiation in a 9-cm. gold screen. P. EHRENFEST, jun. (Compt. rend., 1938, **207**, 573—576; cf. A., 1938, I, 171).—The effect of a 9-cm. Au screen on cosmic radiation passing through 16 cm. of Pb has been studied, energy losses being measured with a double cloud-chamber. The existence of a group of particles of low energy loss is indicated (cf. Auger, A., 1935, 560). The results are not in agreement with the conclusions of Blackett and Wilson. A. J. E. W.

Penetrating component of cosmic radiation and Hoffmann impacts excited by it. H. EULER (Z. Physik, 1938, **110**, 692—716).—Theoretical. The penetrating component is assumed to consist of heavy electrons. It is probable that the proportion of Hoffmann impacts not ascribable to cascade excitation is excited by this penetrating radiation; an explosive mechanism is postulated and the action cross-section of the particles is calc. H. C. G.

Electronic constitution of diamond. D. H. EWING (Physical Rev., 1937, [ii], **51**, 1002). L. S. T.

Determination of electron affinities and valency states with the aid of interpolation formulæ in the theory of complex spectra. H. HELLMANN and M. MAMOTENKO (Acta Physicochim. U.R.S.S., 1937, **7**, 127—147).—Theoretical. Electron affinities and energies of valency states have been calc. for F, O, N, and C. E. S. H.

Calculation of electron affinities from optical data by means of a new extrapolation formula. II. M. MAMOTENKO and H. HELLMANN (Acta Physicochim. U.R.S.S., 1938, **8**, 1—8).—Theoretical. J. A. K.

Dirac electron theory. E. L. HILL and R. LANDSHOFF (Rev. Mod. Physics, 1938, **10**, 87—132).—A review of the principal properties of the Dirac equation and of its solutions. F. J. L.

Intrinsic transverse energy of an electron. G. BECK (Compt. rend., 1938, **207**, 528—530).—A theoretical interpretation is given for the transverse component of the energy of an electron in interaction with an electromagnetic field. A. J. E. W.

Analogy between the photon and electron and the derivation of the quantum equation. H. T. FLINT (Proc. Physical Soc., 1938, **50**, 899—909).—Mathematical. On the view that the theory of the electron is exactly analogous to the theory of a photon, a quantum law is derived and discussed, and is shown to require the existence of the first-order equation of the quantum theory. N. M. B.

History of the conception of the axiality of the structure of the electron. J. STARK (Physikal. Z., 1938, **39**, 735—736).—A review of the basis of Stark's theory of the axial structure of the electron and the theory of Parson and Compton. A. J. M.

Multiple structure of the electron. U. KAKINUMA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 991—1000).—Mathematical. In the theory proposed a stationary electron has a spherically symmetrical multiple structure. The inner core contains the mass and charge and the outer region is the ordinary electromagnetic field in which the energy mc^2 is stored. The energy in the core consists of two parts: one of fixed val. corresponding with the spin magnetic energy, and the other of variable amount sharing the kinetic energy with which the electron describes a certain Bohr orbit. The spin angular momentum is identified with the intrinsic action of the electron, and the corresponding magnetic moment calc. classically gives the correct val. $-he/2mc$. N. M. B.

Theory of spin. W. WESSEL (Z. Physik, 1938, **110**, 625—659).—Theoretical. L. G. G.

Variational theory of the α-particle. H. MARGENAU and W. A. TYRRELL, jun. (Physical Rev., 1938, [ii], **54**, 422—435).—Mathematical. The energy of the normal state of the α-particle calc. by an elaborate variational method agrees well with an independent calculation (cf. A., 1938, I, 9), and allows the convergence limit to be determined with precision. Comparison with previous work on ^3H is made (cf. *ibid.*, 10). The method is employed to calculate the excited singlet and triplet states of the α-particle and gives results previously stated (cf. *ibid.*, 115). No excited state is stable. A virtual excited state exists near the energy of dissociation into four particles. N. M. B.

β-Disintegration. A. I. ALICHANIAN (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 135—147).—Investigation of the β-spectra of heavy and light radioactive elements in the region of small energies indicates the effect of the electric field of the nucleus on the spectrum of the emitted electrons, which causes an increase in the probability of the emission of electrons of small energies and should be evident in an asymmetry of the β-spectrum. The β-spectra of light elements are all of the same type. The process of β-disintegration may be regarded in the same light as that of pair-formation. The distribution calc. by Fermi does not agree with experiment, but there is agreement with the theoretical distribution of Uhlenbeck and Konopinsky over the whole range except the ends of the spectrum. A. J. M.

Theory of β-disintegration. W. PAULI (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 149—152).—It is shown that the exact treatment of the Fermi theory of β-disintegration leads to an infinite self-energy for the particles and that the application of the closer approx. of the distortion theory to β-disintegration is not correct. A. J. M.

Scattering of protons by protons. P. P. PAVINSKI (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 221—227).—The theoretical scattering of protons by protons (scattering angle 45°) in the energy range 200 e.kv. to 10 Me.v. is calc. for two forms of potential energy interaction. The abs. no. of scattered particles at 45° is a max. at about 2 Me.v. A. J. M.

Stable states of two deuterons. H. PARKER (Physical Rev., 1937, [ii], **51**, 682—683).—Theoretical. L. S. T.

Coulomb energy of light nuclei. H. A. BETHE (Physical Rev., 1938, [ii], **54**, 436—439).—The Coulomb energy is calc. for ^3H, ^6He, ^7Li, ^8Li, ^9Be, ^{10}Be, ^{11}B, ^{12}B, ^{13}C, ^{14}C, ^{15}N, and ^{17}O. Theoretically and experimentally the val. should lie between the results of two assumptions which are investigated: (*a*) that the nuclear radius ∝ the cube root of the no. of particles, (*b*) that the wave function of the last neutron or proton extends beyond the surface of the residual nucleus by an amount determined by its binding energy. Consideration of unknown nuclei shows that ^{10}C and ^{14}O are highly stable, ^6B unstable, ^9B probably unstable, and ^8B and ^{12}N of doubtful stability. N. M. B.

Perturbation theory of light nuclei: ^{16}O. W. J. KROEGER and D. R. INGLIS (Physical Rev., 1937, [ii], **51**, 1003). L. S. T.

Analytic wave functions for nuclear and atomic collision problems. P. M. MORSE (Physical Rev., 1937, [ii], **51**, 1003).—A wave function given for calculating inelastic and exchange collision cross-sections furnishes more accurate results than the Born approximation. L. S. T.

Interaction of neutrons and nuclei. I. V. KURTSCHATOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 157—171).—The general problem is discussed from the point of view of the breadth of resonance and absorption bands of neutrons. The neutron and radiation breadth of the bands agrees with statistical theories of the nucleus. A. J. M.

Angular distribution of nuclear fragments. C. REINSBERG (Z. Physik, 1938, **110**, 765).—A correction (cf. A., 1938, I, 170). L. G. G.

Nuclear forces. I. E. TAMM (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 209—219).—A crit. review of present knowledge of nuclear forces. A. J. M.

Conception of an atomic structure of space. A. MARCH (Naturwiss., 1938, **26**, 649—656).—Theoretical. A. J. M.

Pair formation under the action of γ-rays. A. I. ALICHANOV (Bull. Acad. Sci. U.R.S.S., Sér. Phys., 1938, 33—45).—The experimentally determined probability of pair-formation and its dependence on the at. no. of the element irradiated with *X*-rays agree well with vals. calc. on the basis of relativistic quantum mechanics. The experimental distribution of energy between components of a pair also agrees with theory. A. J. M.

Non-elastic dispersion of photons about nuclei with pair production. M. MARKOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 125—127).—Mathematical. T. H. G.

Definition of the neutrino. J. SOLOMON (Compt. rend., 1938, **207**, 526—528).—Theoretical. A. J. E. W.

Stability of stellar neutron cores. J. R. OPPENHEIMER and R. SERBER (Physical Rev., 1938, [ii], **54**, 540).—A general discussion of radiation energies and limiting core masses. N. M. B.

Theory of heavy atomic nuclei. I. Neutron excess in heavy atomic nuclei. II. Flattening of the Gamow barrier by excitation of the atomic nucleus. E. BAGGE (Ann. Physik, 1938, [v], **33**, 359—388, 389—403). O. D. S.

Photo-electric cross-section of the deuteron. K. WAY and J. A. WHEELER (Physical Rev., 1937, [ii], **51**, 683). L. S. T.

Λ-Type doubling in the $^3\Pi$ state of OH^+. C. N. CHALLACOMBE (Physical Rev., 1937, [ii], **51**, 1001). L. S. T.

Correlations between electronic states of atoms and molecules in the alkaline-earth hydrides. B. GRUNDSTRÖM (Nature, 1938, **142**, 614—615).—A discussion (cf. A., 1936, 775; 1938, I, 384). L. S. T.

Comparative study of the visible and ultra-violet colour of inorganic oxides and of their hydroxides and hydrates. A. BERTON (Compt. rend., 1938, **207**, 625—627).—Absorption data obtained by a reflexion method are given for oxides of B, Na, Cr, Co, Ni, Cu, Cd, Zn, Ti, Sn, Sb, Nd, Sm, Pb, and Bi, and for corresponding hydroxides and hydrates. In general, hydroxide or hydrate formation causes a shift of absorption bands towards higher ν, hydroxides showing less absorption in the visible region than the related oxides. A. J. E. W.

Predissociation observed in the molecular spectrum of sulphur vapour. M. DÉSIRANT and B. ROSEN (Physica, 1938, **5**, 870—874; cf. A., 1936, 1309).—In the spectrum of S_2, excited by high-frequency discharge at low temp. and at 10^{-3} mm., the bands arising from the levels with $v' > 10$ either do not appear or are at most 10^{-3}—10^{-4} of the intensity of bands arising from the levels $v' \neq 10$. This is interpreted as indicating that predissociation is, at least in part, spontaneous. The conclusions of Lochte-Holtgreven (A., 1937, I, 1; 1938, I, 335) and of Olsson (A., 1938, I, 107) are criticised. J. W. S.

Vibrational analysis for a new CuCl band system excited by active nitrogen. S. BLOOMENTHAL (Physical Rev., 1938, [ii], **54**, 497—498).—Data and an analysis for the λλ 3789—4159 system are tabulated and an expression for the wave no. of any band head in the system is given. The system has a common lower state with five other systems in the visible. N. M. B.

Near ultra-violet band system of SnO. W. JEVONS (Proc. Physical Soc., 1938, **50**, 910—913).—From a re-examination of data, a revised expression for the frequency of the band head of the $A \rightleftarrows X$ system is proposed, thereby eliminating anomalies previously reported (cf. A., 1937, I, 596) in the anharmonic coeffs. N. M. B.

Ultra-violet absorption spectra obtained by reflexion of some molybdenum compounds in the solid state. (MME.) Z. SOUBAREW-CHATELAIN (Compt. rend., 1938, **207**, 580—582).—Data for a no. of molybdates are recorded. The existence in the solids of the ions MoO_4'' and Mo_2O_7'' is deduced; these ions give absorption bands with upper limits at 2800 and 3600 A., respectively; absorbing cations cause displacement to higher λλ. Molybdates higher than $M^1_2Mo_2O_7$ probably contain admixed MoO_3. MoO_3,H_2O gives the Mo_2O_7'' band, and should probably be formulated $H_2Mo_2O_7,H_2O$. A. J. E. W.

Absorption of light by crystals. N. F. MOTT (Proc. Roy. Soc., 1938, **A**, **167**, 384—391).—The energy of a quantum of radiation can be converted into heat, re-emitted as fluorescent radiation, or used up in producing a photo-electric current in the solid; estimates are made of the dependence on temp. of the relative probabilities of these processes and the results are compared with experimental data for NaCl, KCl, KBr, and AgBr. G. D. P.

Excitation centres in alkali halide crystals. H. WOLFF (Z. Physik, 1938, **110**, 512—528).—Absorption bands of colour centres in pure synthetic NaCl, natural rock-salt, synthetic KCl, KF, and KBr, as well as NaCl and KCl to which small amounts of $SrCl_2$ and $NaNO_3$ were added, have been investigated. Coloration in KCl and KBr can be excited only at low temp. The addition of small quantities of $SrCl_2$ or $NaNO_3$ to NaCl, or of $SrCl_2$ to KCl, shifts the absorption max. towards the red. The shift increases with increase of added impurity, reaching a max. of 10 mμ. in the case

of NaCl, and is independent of temp. Plastic deformation of the crystals produces a similar shift. Results are discussed. H. C. G.

Temperature-dependent transition probability in the absorption spectra of the rare earths. H. EWALD (Z. Physik, 1938, **110**, 428—435).—The intensities of the group of absorption lines (17350 cm.$^{-1}$) of Zn–Nd double nitrate are examined with reference to the dependence of transition probability at different temp. and crystal orientations. The total intensity of all the lines in the group is independent of crystal orientation and temp., but that of lines arising from the II ground term level increases by an amount predictable from the Boltzmann law. The transition probability is in some way dependent on crystal orientation. L. G. G.

Narrow absorption bands in solutions of praseodymium salts. A. SEIDEL and J. LARIONOV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 683—686).—The absorption spectrum of a solution of $Pr_2(SO_4)_3$ ($1{\cdot}9 \times 10^{20}$ Pr IV ions per c.c.) has been measured using a grating spectrograph. Three narrow bands are observed, λλ 4440, 4690, and 4820, the oscillator strengths being 20, 6, and 4×10^{-6} respectively. These bands are due to the $4f$—$4f$ transitions. F. J. L.

CH bands in the night sky spectrum. J. CABANNES, J. DUFAY, and J. GAUZIT (Nature, 1938, **142**, 718—719).—Evidence for the view that known CH bands probably exist in the spectrum of the night sky is put forward. L. S. T.

Light absorption of aromatic hydrocarbons. T. FÖRSTER (Z. physikal. Chem., 1938, **B**, **41**, 287—306).—Relations between absorption and structure are discussed in relation to modern theories. A simplified method of calculating absorption λλ in the ultra-violet and visible is derived and applied successfully to data for seven ring compounds. C. R. H.

Absorption spectra of biacene and fluorocyclene. (MLLE.) B. TWAROWSKA (Bull. Acad. Polonaise, 1938, **A**, 143—152).—The ultra-violet absorption spectra of biacene, $C_{24}H_{16}$, and fluorocyclene, $C_{48}H_{28}$, in the solid state, in *o*-xylene solution at 16° and −180°, and (for biacene only) in the vapour state are described. Frequency differences are assigned to constituent groups and similarities in the two spectra are considered. The influence of solvent and of change of physical state on the λλ of the bands is discussed. W. R. A.

Absorption spectra of methyl α-methacrylate and its polymeride. J. W. GOODEVE (Trans. Faraday Soc., 1938, **34**, 1239—1244).—Extinction coeffs. in the range λ 4000—2100 A. have been determined for $CH_2{\cdot}CMe{\cdot}CO_2Me$ (I), pure and dissolved in C_6H_{14}, and for the polymeride (II) formed under various conditions. The shape of the log ε–λ curve for (I) (similar for acrylic and α-crotonic acids) is ascribed to the double bond rather than to a particular group, and is markedly changed after polymerisation. (II) is in general more transparent at λλ shorter than 3000 A. and differences between different preps. are attributed to the presence of varying amounts of (I). F. L. U.

Absorption coefficients of the acetyl halides. D. H. ETZLER and G. K. ROLLEFSON (J. Chem. Physics, 1938, **6**, 653).—The absorption coeffs. of AcCl, AcBr, and AcI for Hg lines between 2537 and 3650 A. have been measured. The decomp. products have been analysed. No H_2, C_2H_4, or C_2H_6 was found. The gaseous products included CO, CH_4, and the appropriate Me halide. AcCl gave also a dark brown liquid which appears to be a polymeride of either Ac_2 or keten. AcBr gave no liquid, but free Br and possibly $C_2H_4Br_2$. Free I and a very small quantity of a liquid (too small for analysis) were obtained from AcI. W. R. A.

Absorption spectra of 4-(*p*-dimethylaminostyryl)pyridine and 2 : 4-di-(*p*-dimethylaminostyryl)pyridine methiodides.—See A., 1938, II, 457.

Absorption of ultra-violet light by some organic substances. XLVII. L. MARCHLEWSKI and B. SKARŻYŃSKI (Bull. Acad. Polonaise, 1938, **A**, 232—235).—The spectra of EtOH solutions of apiin, apigenin, and quercitrin are recorded and discussed. W. R. A.

Relations between chemical activity and absorption in the ultra-violet of certain organic molecules. I. Absorption spectra of the chloro-derivatives of the substituted amides of malonic acid. (MME.) RAMART, K. G. NAIK, and C. M. MEHTA (J. Indian Chem. Soc., 1938, **15**, 421—425).—Ultra-violet absorption has been measured for $CCl_2(CO{\cdot}NHR)_2$ (R = Ph, *o*-, *m*-, and *p*-C_6H_4Me, 1 : 3 : 4-$C_6H_3Me_2$, C_7H_{15}, CH_2Ph), $NH_2{\cdot}CO{\cdot}CCl_2{\cdot}CO{\cdot}NHR$ (R = *p*-C_6H_4Me, C_6H_4Cl), and $CH_2Cl{\cdot}CCl(CO{\cdot}NHR)_2$ (R = Ph, *o*- and *p*-C_6H_4Me). By comparison with the similarly *N*-substituted malondiamides (A., 1934, 993) the curves are shifted towards the visible region with change of CH_2 into CCl_2. F. R. G.

Stark effect in rotation spectra. S. K. CHAKRAVORTY (Z. Physik, 1938, **110**, 688—691).—Calculation of the terms of the quadratic Stark effect in rotation spectra on a basis different from that of Manneback leads to different results. The discrepancy is explained. H. C. G.

Far infra-red spectrum of quartz mercury lamps. B. KOCH (Ann. Physik, 1938, [v], **33**, 335—358).—The spectra of different types of Hg lamp are compared. Emission can be observed to 0·5 mm. (500 μ.). The absorption of fused quartz and of LiF has been measured from 220 to 450 and 220 to 360 μ., respectively. The infra-red radiation is strongly absorbed by a second Hg lamp. O. D. S.

Absorption spectra of copper, cobalt, and nickel sulphates in heavy water. A. A. ZANKO and A. E. BRODSKI (Acta Physicochim. U.R.S.S., 1938, **8**, 309—314).—Measurement of the absorption curves of $CuSO_4$, $CoSO_4$, and $NiSO_4$ in H_2O and D_2O confirms preliminary observations (A., 1937, I, 131) that replacement of H_2O by D_2O does not cause a shift in the absorption max., but produces a symmetrical compression of the absorption curves. W. R. A.

Infra-red absorption spectrum of sulphur trioxide. H. GERDING and J. LECOMTE (Nature,

1938, **142**, 718).—The infra-red absorption and Raman spectra (details given) of gaseous and liquid SO_3 show that the free mol. of SO_3 has a plane, practically symmetrical configuration, but in the liquid state the single mol. is considerably deformed. L. S. T.

Infra-red absorption of strong and weak acid solutions. E. K. PLYLER (Physical Rev., 1937, [ii], **51**, 685).—Aq. HCl and HBr (1—8N.) show intense absorption at 5·4 μ. Aq. AcOH and $EtCO_2H$ show strong absorption at 5·75 μ. Other strong acids produce the band at 5·4 μ. which is attributed to the hydrated ion, and other weak acids in the band at 5·75 μ. which is attributed to the hydrated acid mol. L. S. T.

Infra-red and Raman spectra of crystalline hydrogen chloride. E. LEE, G. B. B. M. SUTHERLAND, and C. K. WU (Nature, 1938, **142**, 669).—Measurements of the absorption near 3·7 μ. of thin layers of solid HCl at the temp. of liquid air agree with those of Hettner (A., 1934, 829); the lines reported by Shearin (A., 1935, 1300) were not observed. Solid DCl near 5 μ. at the same temp. gives three max. with indications of more structure. The two extreme max. appear to correspond with the max. of the HCl doublet. The Raman spectrum of HCl at the same temp. consists of a line at 2709 cm.$^{-1}$ which is stronger and broader than a second line at 2759 cm.$^{-1}$ L. S. T.

Absorption spectra of *cyclo*propane, ethylene oxide, ethylene sulphide, and ethyleneimine in the photographic infra-red. E. H. EYSTER (J. Chem. Physics, 1938, **6**, 576—579).—The absorption spectra of the above compounds have been investigated from 7000 to 12,000 A. and their symmetries, infra-red activities, and the irreducible representation of their high-frequency fundamental modes have been considered. Some of the observed bands are assigned as third harmonics of the C–H stretching νν and, so far as possible, bands which appear to be analogous are correlated. No band shows rotational fine structure but significant characteristics of the band envelopes are discussed. W. R. A.

Spectrum of allene in the photographic infra-red. E. H. EYSTER (J. Chem. Physics, 1938, **6**, 580—585).—Using a 6-m. path the spectrum of allene has been investigated from 7000 to 12,000 A. at pressures from 40 mm. to 1·5 atm. The mol. has D_{2d} symmetry and its spectroscopic selection rules are discussed. 11 observed bands are assigned to overtones and combinations of fundamental νν. Rotational analysis of the band at 11,444 A. yields the val. 97×10^{-40} g. cm.^{2} for the largest moment of inertia. Both in C_2H_4 and in allene C—H is 1·087 A., C=C is 1·330 A., and the angle H–C–H is 116°. W. R. A.

Infra-red study of alcohol–acetate mixtures. E. S. BARR (Physical Rev., 1937, [ii], **51**, 685).—The infra-red spectra of MeOH, EtOH, their acetates, and mixtures of these components have been obtained in the region 4—8 μ. Mixtures of EtOH + MeOAc and MeOH + EtOAc, after refluxing for 36 hr. and keeping for 6 months, showed only bands due to the original constituents, indicating that no exchange reaction occurs in absence of H_2O. L. S. T.

Influence of non-polar solvents on the infra-red CH absorption bands. Application to $CH_2X{\cdot}CH_2X$ molecules. Y. TA (Compt. rend., 1938, **207**, 583—585).—The CH bands (~ 1·5 μ.) given by dissolved solids and liquids occur at higher λλ in CS_2 than in CCl_4. These results indicate a difference in mol. field, coupling between solvent and solute mols. occurring in CS_2. Considerable changes occur in the intensity of the CH bands of $(CH_2Cl)_2$ (I) on addition of CS_2 or CCl_4; this is due to an equilibrium between *cis*- and *trans*-forms, the position of which is changed by dilution. Similar but smaller changes occur with $(CH_2Br)_2$. At room temp. $(CH_2Br)_2$ probably contains more *cis*-form than (I). $CH_2Cl{\cdot}CH_2Br$ resembles (I) in behaviour. A. J. E. W.

Infra-red absorption studies. V. Association in the carboxylic acids. VI. Association in the acid amides and oximes. VII. Complex formation due to hydrogen bonding. A. M. BUSWELL, W. H. RODEBUSH, and M. F. ROY (J. Amer. Chem. Soc., 1938, **60**, 2239—2244, 2444—2449, 2528—2531; cf. A., 1937, II, 457).—V. The influence of H linking on infra-red absorption spectra is discussed in relation to carboxylic acids. Curves for AcOH, BzOH, and BzOD are given.

VI. Data are recorded for $NH_2{\cdot}COEt$, NH_2Bz, NHAcEt, acetoxime, and the oximes of *cyclo*hexanone, $COPh_2$, and Me_2 and Ph_2 triketone in CCl_4. Association due to H linking is observed, and is accompanied by enolisation in mono-substituted amides. The similarity of the absorption due to association in the substituted amides and that due to the peptide group in gelatin is discussed.

VII. Data are recorded for HCl, quinoline–$CHCl_3$, $COMe_2$–$CHCl_3$, and Et_2O–$CHCl_3$ in CCl_4. The rule (Venkateswaran), that the shift of the fundamental absorption band to longer λ when H forms a linking is greater, and the band is broader, the more active (acidic) is the H, is verified. A $CHCl_3$ absorption band which shifts to shorter λ on addition of quinoline has been observed; this is ascribed to the first harmonic of the perpendicular vibration of $CHCl_3$ which mainly involves H. E. S. H.

S–H frequency of the mercaptans. D. WILLIAMS (Physical Rev., 1938, [ii], **54**, 504—505).—The transmission spectra of $CH_2Ph{\cdot}SH$, Bu^{n}SH, and Pr^{n}SH, investigated in the range 2·75—4·25 μ., showed, in addition to the bands near 3·3 μ. arising from the C–H linkages, absorption max. at 3·85, 3·80, and 3·83 μ., respectively. These are attributed to a vibration of the SH group. Comparison of data with existing Raman and infra-red data is given. N. M. B.

Quenching of fluorescence of dye solutions by foreign substances. II. Influence of the solvent on quenching processes. B. J. SVESCHNIKOV (Acta Physicochim. U.R.S.S., 1937, **7**, 755—766; cf. A., 1936, 1445).—Experiments on the quenching of (i) fluorescein by KI in aq. glycerol and sugar solutions, (ii) rhodulin-red by NH_2Ph in different alcohols, and (iii) rhodamin B by NH_2Ph in various solvents, support previous evidence that in general the chemical properties of the solvent affect the quenching effect only slightly, the η of the solvent

being the main factor. However, notable exceptions from this general rule occur which indicate that other factors must be considered. The formulæ expressing the quenching of fluorescence by foreign substances involve the sphere of action and the efficiency of the collision between two mols., and, generally, these parameters depend on η. W. R. A.

Mechanism of the chemiluminescence of 3-aminophthalhydrazide. I. B. J. SVESCHNIKOV (Acta Physicochim., U.R.S.S., 1938, 8, 441—460).—The mechanism of the reaction between 3-aminophthalhydrazide (I) and H_2O_2 in an alkaline medium has been investigated by studying the effects of changes in the concn. of the components on the intensity and efficiency of the chemiluminescence that accompanies the reaction. At 52° the rate of the reaction increases slightly as the concn. of (I) decreases. For a given concn. of (I), the intensity of the luminescence is determined mainly by the ratio $[H_2O_2]:[NaOH]$. The data are best interpreted by the hypothesis that the luminescence is emitted by unstable, intermediate compounds formed during hydrolysis of (I). L. S. T.

Physics and application of phosphors in light technology. R. FRERICHS (Naturwiss., 1938, **26**, 681—687).—A review dealing with the physics of phosphorescence and fluorescence, and the excitation of phosphors by light and cathode rays. A. J. M.

Light scattering in the wings of Rayleigh lines in carbon disulphide. J. PNIEWSKI (Bull. Acad. Polonaise, 1938, **A**, 136—142).—The curve showing the distribution of intensity of light in the wings of Rayleigh lines for CS_2 does not agree with the theoretical curve obtained on the assumption that these lines are due to diffusion of rotation bands. W. R. A.

Variation of the structure of water through ions. T. G. KUJUMZELIS (Z. Physik, 1938, **110**, 742—759).—Raman spectra of aq. solutions of Cl′, Br′, I′, NO_3', ClO_3', ClO_4', IO_3', CO_3'', and SO_4'' ions are obtained and the significance of their structure is discussed in relation to hydration, viscosity, and ionic mobility. The ions vary the H_2O structure, in most cases weakening the H-bonds. L. G. G.

Vibrations and structure of XO_3 ions. T. G. KUJUMZELIS (Z. Physik, 1938, **110**, 760—762; cf. A., 1938, I, 496).—New measurements of the Raman spectrum of aq. 5N-HIO_3 are reported. The author's measurements and conclusions in respect of the ions ClO_3', BrO_3', and IO_3' are in agreement with those of Shen *et al.* (A., 1937, I, 218) but only in part with those of Venkateswaran (A., 1938, I, 228). H. C. G.

Raman spectra in solution. III. Phosphorus and bismuth trichlorides in different solvents. A. E. BRODSKI and L. V. KORTSCHAGIN (Acta Physicochim. U.R.S.S., 1937, **7**, 791—796).—Raman displacements for PCl_3 in Et_2O, CS_2, and $CHCl_3$, and of $BiCl_3$ in HCl, are recorded and compared with existing data. The variation of the intensity of PCl_3 lines in $CHCl_3$ with $[PCl_3]$ is discussed. W. R. A.

Raman spectrum of molybdic acid in aqueous solution. (MLLE.) M. THÉODORESCO (Compt. rend., 1938, **207**, 531—532).—1·6—2N-H_2MoO_4 gives three principal νν (950, 901, and 853 cm.$^{-1}$). Comparison is made with data for molybdates (A., 1938, I, 296). A. J. E. W.

Raman spectrum of liquid diborane. T. F. ANDERSON and A. B. BURG (J. Chem. Physics, 1938, **6**, 586—591).—Utilising a method for the Raman effect of liquefied gases which is described, the Raman spectrum of liquid diborane has been measured. It contains some 16 lines after 5 hr. exposure. The symmetrical stretching vibrations for the three isotopic analogues containing ^{11}B–^{11}B, ^{11}B–^{10}B, and ^{10}B–^{10}B have the vals. 793, 806, and 821 cm.$^{-1}$ respectively. Both the isotopic shifts and intensities are in agreement with predicted vals. The spectrum is compared with recorded data for C_2H_6 and Si_2H_6. Force consts. have been evaluated; internuclear distances are compared with those derived by electron diffraction methods. The large vals. of the B–B, C–C, and Si–Si force consts. suggest that these bonds are compressed by forces which hinder internal rotation. The entropy of B_2H_6 (*g*) at 25° has been computed as approx. $55·3 \pm 1·5$ g.-cal. per degree. Combined with the known heat of formation ($44{,}000 \pm 3{,}000$ g.-cal.) the free energy of formation of B_2H_6 (*g*) at 25° is $-30{,}000 \pm 4000$ g.-cal. B_2H_6 decomposes at room temp. into other hydrides for which thermodynamic data are not available and, therefore, the true stability of B_2H_6 cannot be completely ascertained. W. R. A.

Variation of the Raman spectrum of nitrate solutions with cation. (MISS) E. R. LAIRD and (MISS) F. M. PLESSET (J. Chem. Physics, 1938, **6**, 592—594).—The observations of Grassmann (A., 1932, 1075) have been confirmed that the strong Raman displacement of NO_3' tends to lower vals. when aq. solutions of $Pb(NO_3)_2$ and $AgNO_3$ of increasing concn. are examined but remains sensibly const. for solutions of $Cd(NO_3)_2$ of varying concns. The different behaviours are attributed to influences of the cation on the structure of the H_2O. W. R. A.

Raman frequencies of hexamethylene glycol. R. C. WILLIAMSON (J. Chem. Physics, 1938, **6**, 653).—12 νν are recorded. W. R. A.

Raman spectra of (A) trialkyl borates, (B) dialkyl sulphates. M. MILONE (Atti R. Accad. Sci. Torino, Cl. Sci. fis., 1936, **71**, I, 391—394, 344—347; Chem. Zentr., 1937, i, 569).—(A) Following Cabannes (A., 1932, 792), Raman spectra suggest a pyramid on a triangular base as the steric structure of trialkyl borates.

(B) Characteristic SO_4'' lines are absent from the Raman spectra of Me_2SO_4 and Et_2SO_4, which are given the structure $SO_2(OMe,Et)_2$, recalling the formulation $(HO)_2S(O_2)$. A. H. C.

Application of the Raman effect to the study of *cis–trans* isomerism in some cyclic compounds. G. CHIURDOGLU and A. GUILLEMONAT (Bull. Soc. chim., 1938, [v], **5**, 1328—1333).—Raman data are given for *cis-* and *trans*-1 : 2-dimethyl-, -methylethyl-, -diethyl-, and -methyl-*n*-propyl-*cyclo*pentane, 1 : 2-dimethyl-, -diethyl- (*trans* only), and -methyl-*n*-propyl-*cyclo*pentanol, and *o*-, *m*-, and *p*-dimethyl-

*cyclo*hexanol. Generalisations are given which enable the configurations to be deduced from the Raman spectra. A. J. E. W.

Raman effect. LXXXVIII. Propiolic acid and its esters. R. SABATHY (Z. physikal. Chem., 1938, **B**, **41**, 183—188).—Raman spectra of propiolic acid (I) and its Me and Et esters have been determined. The influence of attached groups on the ν characteristic of C:C and C:O are discussed. The spectrum of (I) indicates that dimerisation exists to some extent. W. R. A.

Anomalous charging current in Rochelle salt crystals. F. SEIDL (Physikal. Z., 1938, **39**, 714—716).—The dependence of the current (I) on time (t) after application of potential has been investigated for Rochelle salt. The I–t curve is hyperbolic ($I = kt^{-m}$) for $t = (2{\cdot}6$ to $8{\cdot}1) \times 10^{-3}$ sec. For $t < 2{\cdot}6 \times 10^{-3}$ sec. the above law does not hold. The I–E curve follows Ohm's law for small t. The initial current depends on the thickness of the prep. A. J. M.

Electrical breakdown of the alkali halides. R. J. SEEGER and E. TELLER (Physical Rev., 1938, [ii], **54**, 515—519).—Mathematical. The mechanism proposed by von Hippel (B., 1938, 398) is justified, and calc. vals. of the breakdown field show satisfactory agreement with experiment. A crit. comparison with Fröhlich's explanation (cf. A., 1937, I, 444) is made. N. M. B.

Dielectric properties of cozymase and adenylic acids from muscle and yeast.—See A., 1938, III, 1046.

Measurement of the dielectric constant of cellulose. H. A. DE LUCA, W. B. CAMPBELL, and O. MAASS (Canad. J. Res., 1938, **16**, **B**, 273—288).—The following method has been devised for measuring the dielectric const. ϵ_X of a substance X which cannot be made to fill the condenser completely. Taking two completely miscible liquids A and B such that $\epsilon_A < \epsilon_X < \epsilon_B$, vals. of ϵ_{AB} are measured for a complete range of mixtures of the two, and a curve of ϵ_{AB} against composition is plotted. A quantity of X is introduced into the condenser, which is then filled with various mixtures AB in turn and a new curve of ϵ against composition is obtained. The curves intersect at ϵ_X. Using mixtures of C_6H_6 and $(CH_2Cl)_2$, ϵ has been measured for cellulose and found to be 6·1. T. H. G.

Dielectric constants of solid bodies by the ponderomotive force method. IV. D. DOBORZYŃSKI (Bull. Acad. Polonaise, 1938, **A**, 153—168; cf. A., 1938, I, 345).—The dielectric consts. ϵ of quartz glass (I) and cryst. quartz (II) have been measured by the ponderomotive force method between −190° and 18°. For (I), ϵ decreases from 3·92 at 18° with falling temp.; it passes through a min. val. of 3·3 at ~ −70°, rises to the initial val. at −85°, and remains const. with further temp. fall. The polarisation P behaves in an analogous manner. The significance of the identity of the temp. at which the min. in ϵ and the max. of density occur is discussed. For (II), the const. ϵ_1, obtained with the crystal suspended with its optical axis vertical, behaves in a way similar to ϵ of (I); it falls from 4·55 at 18° with temp. decrease, passing through a min. of 3·8 at −90° and rising to a const. val. of 4·4 below −110°. ϵ_{II}, obtained with the optical axis horizontal, is practically temp.-independent, decreasing from 4·66 at 18° to 4·48 at −190°. Measurements have also been made on Na K tartrate. W. R. A.

Dependence on state of the dielectric polarisations of ammonia and its three methylated derivatives. R. J. W. LE FÈVRE and P. RUSSELL (Nature, 1938, **142**, 617).—The vals. recorded for the dielectric polarisations of NH_3, NH_2Me, $NHMe_2$, and NMe_3 in the gaseous and liquid states, and dissolved in C_6H_6, show that for NH_3 and NH_2Me polarisation in the gaseous state is > that in the liquid, but for $NHMe_2$ and NMe_3 the reverse is true. L. S. T.

Dependence of molecular polarisation on the solvent. A. NIINI (Ann. Acad. Sci. fenn., **A**, 1936, **46**, No. 1; Chem. Zentr., 1937, i, 570).—The determination of the mol. polarisation of CS_2, CCl_4, $CHCl_3$, CH_2Cl_2, MeI, $(CH_2Cl)_2$, $(CHCl_2)_2$, EtCl, EtBr, EtI, $COMe_2$, Pr$^{\alpha}$Cl, n-C_5H_{12}, PhCl, C_6H_6, PhMe, and n-C_7H_{16} in the gaseous, liquid, and dissolved states is described. The causes (dipole induction, anisotropic polarisability, inner field, etc.) of variation with temp. are discussed. A. H. C.

Dielectric polarisation of iodine solutions. S. V. KAFTANOV, V. VASSILIEV, and J. SIRKIN (Acta Physicochim. U.R.S.S., 1937, **7**, 75—84).—Data for 0·0042—0·025M. solutions in C_6H_6 at 15—60° are recorded. The mol. polarisation is $41{\cdot}12 \pm 0{\cdot}12$ cm.^{3} and is independent of temp. I does not possess any dipole moment in C_6H_6 or CS_2. The difference between the electronic polarisation in vapour and in solution is discussed. E. S. H.

Dielectric polarisation of liquid selenium. J. WESOŁOWSKI (Bull. Acad. Polonaise, 1938, **A**, 290—303).—The dielectric const. ϵ of liquid Se, in the temp. range 237·5—301·4°, varies linearly with reciprocal of temp. θ. P, the sp. polarisation, is independent of θ and has the val. 0·1515. The atom polarisation, P_A, obtained from $P \times$ at. wt. is 12·0, whilst the val. obtained from comparison with P_A for O_2 and S is 11·94. W. R. A.

Dielectric polarisation. XXIV. Solvent effect on dipole moments of some amines. E. G. COWLEY and J. R. PARTINGTON (J.C.S., 1938, 1598—1601).—The dipole moments of NH_2Ph, α- and β-$C_{10}H_7 \cdot NH_2$ have been determined in some or all of the solvents C_6H_{14}, *cyclo*hexane, C_6H_6, PhMe. The differences between the polarisations and moments in the different solvents are small. The effect of the solvent on the moments of these and some other amines, alcohols, ethers, and $CHCl_3$ is discussed. A. J. M.

Dipole moments of hydrogen and deuterium chlorides. R. P. BELL and I. E. COOP (Trans. Faraday Soc., 1938, **34**, 1209—1214; cf. A., 1936, 1181).—Polarisation measurements over the range 291—516° K. shows that the dipole moment (μ) for gaseous DCl is > that for HCl ($\mu = 1{\cdot}084 \times 10^{-18}$) by 0·003 or 0·007 $\times 10^{-18}$, according to the method

of calculation. The isotope effect is accounted for chiefly by anharmonicity of the zero-point vibration, which is calc. from infra-red data. Variation of the effective charge with internuclear distance is of minor importance. It is inferred that the instantaneous μ of HCl decreases with increasing internuclear distance near the equilibrium point. F. L. U.

Dipole moments of molecules containing two movable dipoles. J. Y. Beach and D. P. Stevenson (J. Chem. Physics, 1938, **6**, 635—638).—Mathematical. The average dipole moment of a mol. containing two movable dipoles has been calc. as a function of temp. and restriction of internal rotation for three different potential functions involving V_0, the difference in potential energy between the *cis*- and *trans*-modifications of the mol., and ϕ, the angle between the planes containing the dipoles and the axis of rotation. The dipole moments of $(CH_2Cl)_2$, $CH_2Cl{\cdot}CH_2Br$, and $(CH_2Br)_2$ as a function of temp., used with the three potential functions, lead to vals. of V_0, which are compared with vals. obtained by other methods. W. R. A.

Dipole moments of pyrone compounds. V. G. Vassiliev and J. K. Sirkin (Acta Physicochim. U.R.S.S., 1937, **6**, 639—660).—The dipole moments of γ-dimethylpyrone, xanthone, and coumarin, measured in C_6H_6 solution at 15°, 25°, 40°, 55°, and 65°, are 4·62, 2·94, and 4·54 D., respectively. These vals. are $\gg$ those obtained by vectorial addition of the individual polar groups. From the viewpoint of the theory of quantum-mechanical resonance the hybrid mols. with a tervalent ethereal O, and a univalent carbonyl O, possess very high dipole moments. The observed high vals. are thus explained as slight superposition of these states. W. R. A.

Dielectric properties of acetylenic compounds. X. Equipment for measuring dielectric constants of gases. Polarity of gaseous monoalkylacetylenes. F. J. Krieger and H. H. Wenzke (J. Amer. Chem. Soc., 1938, **60**, 2115—2119).—Apparatus and technique for determining dielectric const. at different pressures and temp. are described. The polarisations of gases and vapours have been determined by a method which obviates the necessity of equations of state. Dielectric consts. and polarisations for gaseous CH:CMe, CH:CEt, CH:CPr, CH:CBu, and $CH{:}C{\cdot}C_5H_{11}$ are recorded; the electric moments are 0·77, 0·80, 0·85, 0·87, and 0·86 D., respectively. E. S. H.

Anomalous dispersion and free rotation. A. Budó (Physikal. Z., 1938, **39**, 706—711).—Mathematical. A formula is derived for the mean dipole moment of polar mols. on the assumption that the Maxwell–Boltzmann distribution holds where there are rotating groups. From the formula the refractive and absorption indices can be calc. as a function of frequency. The equation leads to the conclusion that the dielectric loss of a mol. which has rotating groups should be $<$ that of a mol. of the same size and dipole moment but without such groups. A. J. M.

Rotatory dispersion of gelatin in carbamide solutions.—See A., 1938, II, 516.

Paramagnetic rotatory power and magnetisation of the cerium ion in hydrated cerium ethyl sulphate. J. Becquerel, W. J. de Haas, and J. van den Handel (Physica, 1938, **5**, 857—869; cf. A., 1937, I, 452; 1938, I, 498).—Measurements between 1·37° and 290° K. are recorded, and the corresponding vals. of the Verdet const. are deduced. The law found to hold for other Et sulphates is not obeyed even at 1·37° K., probably owing to the two lowest energy levels being very close together. The third energy level is probably very far removed from these. J. W. S.

Crystal fields in rare-earth ethyl sulphates. C. B. Ellis and H. Hall (Physical Rev., 1938, [ii], **54**, 478—479; cf. Ketelaar, A., 1937, I, 502).—The possibility of establishing a cryst. potential based on structure determinations is discussed. No satisfactory agreement with experimental spectral or magnetic data is reached. N. M. B.

Magneto-optic rotations of paramagnetic ions. S. Steingiser and H. Hyman (J. Amer. Chem. Soc., 1938, **60**, 2294—2296).—The partial Verdet consts. of $Fe_2(SO_4)_3,(NH_4)_2SO_4$, $K_3Fe(CN)_6$, and $K_4Fe(CN)_6$ at 0·0282, 0·173, and 0·415 molalities are −1·024, −2·354, and +0·148, respectively; the total Verdet consts. are 0·01253, 0·00571, and 0·01409. Diamagnetic $K_4Fe(CN)_6$ shows a normal rotation, and the other salts show a large negative rotation, due to paramagnetism. E. S. H.

Verdet constant of crystalline nickel sulphate. F. G. Slack, R. T. Lageman, and N. Underwood (Physical Rev., 1937, [ii], **51**, 685).—The const. for $NiSO_4{,}6H_2O$, measured for light normal to the natural cleavage plane, is $\propto \lambda^{-2}$ between 4500 and 6000 A. From −10° to 30° there is a temp. variation $\propto T^{-1}$. L. S. T.

Double intensity of the contact between electrons of double orbital quantum number in the transitional elements. R. Forrer (J. Phys. Radium, 1938, [vii], **9**, 387—392).—The max. no. of contacts in an electronic network (Fe, Co, Ni, and Pd) is 36, obtained by 6 electrons with 6 contacts. On the basis of considerations of the electronic networks of superconductors, it is suggested that the intensity of interaction $\propto$ the orbital quantum no. The hypothesis is applied to the problem of the very high m.p. of the transitional elements. W. R. A.

Structure of electronic shells of diatomic homopolar molecules. V. M. Tschulanovski (Acta Physicochim. U.R.S.S., 1937, **7**, 27—48).—Theoretical. E. S. H.

Structure of electronic shells of diatomic homopolar molecules. II. Excited states. V. M. Tschulanovski (Acta Physicochim. U.R.S.S., 1938, **8**, 113—128).—Theoretical. J. A. K.

Calculations of the lower excited levels of benzene. M. Goeppert-Mayer and A. L. Sklar (J. Chem. Physics, 1938, **6**, 645—652).—Mathematical. By the method of antisymmetrised mol. orbitals, in which no empirical data except the C—C distance in C_6H_6 were used, two weak bands, due to forbidden

electronic transitions at 2500 and 2100 A., and a strong band at 1500 A. have been predicted. W. R. A.

Regular division of space and the structure of matter. I. The filling up of space. G. FOURNIER (J. Phys. Radium, 1938, [vii], **9**, 360—376).—Mathematical. W. R. A.

Corresponding chemical groups. R. LAUTIÉ (Bull. Soc. chim., 1938, [v], **5**, 1321—1328; cf. A., 1938, I, 623).—Relationships between χ, $[R]$, the ionisation energy, the at. vol., the cryst. parameters, and the mol. heat of formation of corresponding elements in Carlsohn groups are considered, the rare gas group being used as a basis for comparison. Carlsohn's law is verified in most cases. Functions giving certain of these consts. in terms of the position in the group and Z are discussed. A. J. E. W.

Is there an essential difference between "ordinary" and "complex" compounds? J. ZERNIKE (Chem. Weekblad, 1938, **35**, 708—709).—Complex anions differ from ordinary ones in that they exist only as ions, and so complex acids are strong and do not form esters or acid salts. S. C.

Free volumes and free angle ratios of molecules in liquids. J. F. KINCAID and H. EYRING (J. Chem. Physics, 1938, **6**, 620—629; cf. A., 1937, I, 452).—Mathematical. Kinetic considerations involving free vols. and free angle ratios indicate that the abnormalities of the so-called associated liquids can be explained entirely from the viewpoint of restricted rotation of the mols. This conception accounts satisfactorily for the observed dielectric polarisations of H_2O and MeOH. W. R. A.

Sensitiveness of paraffin crystal formation to the physical and chemical conditions under which they crystallise. C. M. HECK (Physical Rev., 1937, [ii], **51**, 690).—Certain points in the exterior outline of the normal pinacoidal diamond-shaped tabular crystals are more sensitive than others to change in conditions. Variations in the form of parallel striations across the crystal face are also related to the changes in physical and chemical conditions during formation. L. S. T.

Physical structure of giant organic molecules. P. JORDAN (Naturwiss., 1938, **26**, 693—694).—The theory put forward by Möglich *et al.* (A., 1938, I, 299) that the internal structure of giant org. mols., *e.g.*, genes, viruses, etc., is similar to that of solid bodies, the loose electrons of the mol. being in energy levels belonging to the whole mol. and not localised in certain atoms or in definite valency bonds, is supported by examination of the absorption and inactivation spectra of urease, by the existence of a long-λ limit for the production of mutations by ultra-violet light but the absence of any selective effect in this connexion, and the sp. attraction of similar genes. A. J. M.

Structure and properties of molecules. III. Linking energies and saturation of molecules. IV. Relation between saturation and polarity of molecules. V. RAZUMOVSKI (Bull. Soc. chim., 1938, [v], **5**, 1281—1292, 1292—1306; cf. A., 1938, I, 298).—III. Consideration of the duration of interaction and degree of approach of valency electrons to at. nuclei, and of the degree of electron doublet formation, permits a correlation between the valency maxima and effective valencies of elements. Relations between mol. structure and the strength and reactivity of covalent and co-ordinate linkings are discussed on a similar basis.

IV. The polarity and degree of ionisation in a no. of mols. and their effect on the reactivity and the rate and degree of polymerisation are discussed. A. J. E. W.

Structure of the insulin molecule. D. M. WRINCH and I. LANGMUIR (J. Amer. Chem. Soc., 1938, **60**, 2247—2255).—Published X-ray data for insulin crystals (A., 1938, I, 300) correspond with the C_2 polyhedral structure predicted for the insulin mol. on the basis of the cyclol theory. The data confirm the existence in the insulin mol. of (1) six high-density points at the corners of an octahedron of side 29·4 A.; (2) low-density regions near the centres of the 44 lacunæ in the cyclol fabric, which are located in the edges and faces of the polyhedron; (3) a cage structure; (4) 3 Zn atoms per mol. on lines connecting mol. centres (except along the z axis) and low- and high-density groups attached to these Zn atoms outside the C_2 structure. E. S. H.

Structure of $(SNH)_4$ and its derivatives. M. H. M. ARNOLD (J.C.S., 1938, 1596—1597).—$(SNH)_4$ has the structure $S<^{NH\cdot S\cdot NH}_{NH\cdot S\cdot NH}>S$. *Compounds* of the type $(SNR)_4$, where R = $CH_2\cdot OAc$, p-$O\cdot CH_2\cdot CO\cdot C_6H_4\cdot NO_2$, and $CO\cdot NHPh$ have been prepared. $(SN\cdot OMe)_4$ obtained from CH_2O and $(SNH)_4$ has m.p. 173° (decomp.) and is to be formulated as an alcohol. The name *cyclo*tetrathioimino is proposed for $(SNH)_4$. A. J. M.

Molecular magnitude from dialysis constants. W. NOWATKE (Bull. Acad. Polonaise, 1938, **A**, 218—231).—By means of the relations $\delta_1\sqrt{M_1} = \delta_2\sqrt{M_2}$, $\delta_1\sqrt{n_1} = \delta_2\sqrt{n_2}$, and $\delta_1 r_1 = \delta_2 r_2$, vals. can be obtained for the mol. wt. M, the no. n of atoms in the mol., and the radius r of an undissociated org. mol., from its dialysis coeff. δ, by reference to a mol. of similar structure. W. R. A.

Nuclear separation of the Te_2 molecule by electron diffraction. L. R. MAXWELL and V. M. MOSLEY (Physical Rev., 1937, [ii], **51**, 684).—Electron diffraction photographs obtained from Te vapour show an interference pattern which can be explained by electron scattering from the diat. Te mol. Measurements of the interference max. give a Te—Te separation of $2{\cdot}59\pm0{\cdot}02$ A., which is $\ll$ the band spectra val. of 2·85 A. for the nuclear separation of the ground state of the Te_2 mol. Part, at least, of the accepted rotational consts. computed for Te_2 from band spectra data must be incorrect. L. S. T.

Mayer's theory of condensing systems. W. BAND (J. Chem. Physics, 1938, **6**, 654).—The general results of Mayer (*ibid.*, 1937, **5**, 67) are more directly derived from the theory of dissociating assemblies. W. R. A.

Structure of the centres of the phase boundaries in condensed systems. E. ANDRONIKASCHVILI (Acta Physicochim. U.R.S.S., 1937, **6**, 689—700).—A relation, analogous to the Thomson formula, is derived connecting the size of the equilibrium-crystallisation centres with the supercooling of the melt, and a curve showing the dependence of the work of formation of the centres on their size is obtained. The mechanism for the origin of the stable crystallisation centres is considered in relation to the Gibbs–Volmer theory. The possibility of the origin of centres without the aid of external work is considered. W. R. A.

Calculation of London dispersion forces at small atomic separations. H. HELLMANN and K. MAJEVSKI (Acta Physicochim. U.R.S.S., 1937, **6**, 939—953).—Theoretical. W. R. A.

Movement of anisotropic liquids in an electric field. V. ZVETKOV (Acta Physicochim. U.R.S.S., 1937, **6**, 885—892).—The dielectric anisotropy of the mols. is the principal cause of the movement. W. R. A.

Internal rotation in ethylene chloride. J. Y. BEACH and K. J. PALMER (J. Chem. Physics, 1938, **6**, 639—644).—Assuming the shape of the potential barrier restricting rotation about the C–C bond in $C_2H_4Cl_2$ to be given by a cosine function, the height of the barrier, determined by electron diffraction investigation, is between 5 kg.-cal. per mol. and ∞. This val. is compared with that obtained from the exchange repulsions and the electrostatic repulsions of the two ends of the mol. W. R. A.

Vibration–rotation energy of polyatomic molecules. M. ELIASHEVITSCH (Acta Physicochim. U.R.S.S., 1938, **8**, 9—26).—Mathematical. J. A. K.

Surface tension of activated water "T." G. PICCARDI (Gazzetta, 1938, **68**, 471—473).—γ of H_2O activated by the method previously described (A., 1938, I, 403) does not differ from that of normal H_2O. O. J. W.

Posnjak and Barth's principle of "variate atom equipoints" and "mixed crystals." F. C. BLAKE (Physical Rev., 1937, [ii], **51**, 1000; cf. A., 1932, 217). L. S. T.

Simplified method for indexing Debye-Scherrer-Hull patterns. L. K. FREVEL (Physical Rev., 1937, [ii], **51**, 997—998).—The method depends on recording on a single film a temp. shift of the diffraction pattern of a substance. An interval of 150° usually produces easily-measurable shifts that can be related to the anisotropy of a cryst. substance. The cubic, tetragonal, hexagonal, and orthorhombic systems can be easily indexed. L. S. T.

Integration of large numbers of *X*-ray crystal reflexions. R. H. V. M. DAWTON (Proc. Physical Soc., 1938, **50**, 919—925).—Experiments show that if a positive film is printed from an *X*-ray negative, the change in transparency of the film can be made proportional, over an extended range, to the intensity of the original *X*-ray beam. The transmitted light thus gives the integrated *X*-ray val. of a patch of non-uniform blackening without a two-dimensional point-by-point integration. The application of the principle to *X*-ray analysis of crystal structure is discussed. N. M. B.

Vector maps and crystal analysis. I. LANGMUIR and D. WRINCH (Nature, 1938, **142**, 581—583). L. S. T.

Intensities of the points of photographed reciprocal lattice planes. J. BOUMAN and W. F. DE JONG (Physica, 1938, **5**, 817—832; cf. A., 1938, I, 234).—Theoretical relations are derived which permit the interpretation of the relative intensities observed in the photographs of zero-order reciprocal lattice planes. J. W. S.

Determination of incoherent scattered *X*-radiation in gases. K. HOFFMANN (Physikal. Z., 1938, **39**, 695—706).—Wollan's filter-difference method of determining the incoherent scattered *X*-radiation was used with some modification for investigating the scattering in C_2H_2. The distance $C \equiv C$ obtained was $1{\cdot}15 \pm 0{\cdot}1$ A., in agreement with other methods. Experiments with monochromatic radiation are also described and discussed and the abs. determination of the intensity of the scattered radiation is described. A. J. M.

Planar method of identification of crystalline substances. Films of sodium thiosulphate deposited from a thin layer of its aqueous solution on a plane sheet of glass. New zone of faces parallel to the binary axis. G. CESÀRO and J. MÉLON (Bull. Acad. roy. Belg., 1938, [v], **24**, 558—565).—The crystal structure of $Na_2S_2O_3,5H_2O$, deposited in a thin film on glass, has been studied and compared with the normal crystal structure. The crystallographic characteristics are sufficient to identify $Na_2S_2O_3$. J. W. S.

Data for the construction of models illustrating the arrangement and packing of atoms in crystals. (Formula types A, AB, and AB_2.) M. J. BUERGER and R. D. BUTLER (Amer. Min., 1938, **23**, 471—512; cf. A., 1936, 782; A., 1938, I, 284).—The necessary data are given for Cu, α-Fe, Mg, diamond, white Sn, Bi, Se, graphite, I, black P, halite, CsCl, sphalerite, wurtzite, carborundum, niccolite, pyrrhotite, cinnabar, PbO, calomel, BN, covellite, cooperite, tenorite, fluorite, pyrite, cuprite, rutile, anatase, SnS_2, molybdenite, löllingite, Fe diphosphide and diantimonide, hydrophilite, marcasite, SiS_2, cristobalite, tridymite, and quartz. L. S. T.

Spirals in paraffin crystals. C. M. HECK (Physical Rev., 1937, [ii], **51**, 686).—The characteristics of spirals formed in tabular paraffin crystals are summarised. L. S. T.

Crystalline structure of the double cyanides of barium with platinum, palladium, and nickel. H. BRASSEUR and A. DE RASSENFOSSE (Bull. Soc. franç. Min., 1938, **61**, 129—136).—$BaPt(CN)_4,4H_2O$, $BaPd(CN)_4,4H_2O$, and $BaNi(CN)_4,4H_2O$ (I) have *a* 11·89, 11·98, 11·71; *b* 14·08, 13·82, 13·48; *c* 6·54, 6·73, 6·63 A.; β 103° 54′, 104° 28′, 104° 50′, respectively. The three compounds are monoclinic and isomorphous. Dehydration curves for the ordinary pressure show that mols. of H_2O are liberated at 75° and at 100°. Interat. distances and details of structure for (I)

are recorded. Each Ni is surrounded by 4 CN, all coplanar with Ni. These planes are perpendicular to the c_4 axis of the crystal. Each Ba is surrounded by 6 H_2O and four CN. L. S. T.

Polymorphic transitions in metallic halides. R. B. JACOBS (Physical Rev., 1938, [ii], **54**, 468—474).—*X*-Ray powder analysis of RbI at 4500 kg. per sq. cm. and room temp. shows body-centred cubic crystal form, and lattice const. $4{\cdot}33_5$ A. The vol. change from the face-centred lattice which is stable below 4000 atm. is 0·037 c.c. per g., or about 0·009 c.c. per g. > Bridgman's val. with only approx. hydrostatic pressure, against perfectly hydrostatic pressure in the present case. Calc. data for polymorphic transitions are tabulated for all the Rb and K halides (except the unchanged fluorides) and for AgI. N. M. B.

Two-dimensional crystals of silica. N. A. SCHISCHAKOV (Acta Physicochim. U.R.S.S., 1937, **7**, 727—736; cf. A., 1935, 1309).—Electron diffraction patterns of ordinary sand, low-cristobalite, low-tridymite, SiO_2 gels, and several puzzuolanas have been compared with those of vitreous SiO_2 and pumice stone. The absence of certain rings in the former specimens indicates that the patterns of the latter are due neither to org. impurities nor to the presence of thin cryst. films of hydrous SiO_2 on the surface of the grains. Calculation of the patterns of the puzzuolanas on the assumption of a hexagonal lattice gives 0 for the third index and indicates that the crystals are two-dimensional. The close resemblance of the electron diffraction diagrams of clays and puzzuolanas is explained on the basis of the disintegration of the monoclinic lattices of the clay minerals under the influence of cathode rays, giving amorphous Al_2O_3 and free two-dimensional Si_2O_5 crystals. Most of the diffraction rings of vitreous SiO_2 are due to two-dimensional Si_2O_5 crystals; the extra rings may be due either to some second cryst. phase, or to the presence of the third dimension in the crystals of vitreous SiO_2 built up of the two-dimensional layers so that the whole structure is near to that of high-cristobalite, which it resembles (*loc. cit.*). W. R. A.

***X*-Ray examination of the structure of boron nitride.** A. BRAGER (Acta Physicochim. U.R.S.S., 1937, **7**, 699—706).—Results calc. from *X*-ray powder photographs of BN are discussed in relation to the data given by Hassel (cf. Norsk Geol. Tids., 1926, 266). From the photograph for BN prepared at 1100° a unit cell identical with that of the 2000° prep. is indicated; probable symmetry class is C_{3h}. W. R. A.

Crystallisation of alkali halides on fluorite. L. KRASTANOV and I. N. STRANSKI (Z. Krist., 1938, **99**, 444—448; cf. A., 1938, I, 299).—A crystal lattice face formed by only one type of ion is unstable if complete; a proportion of ions must be lost. It is possible to complete such an ionic layer by the coalescence of two crystal faces. This is illustrated by the deposition from hot saturated solutions of LiCl, LiBr, NaCl, NaBr, KCl, KBr, and KI, on a fresh octahedral CaF_2 surface; the like octahedral (single ion) surfaces grow coplanar with the base. Further orientation may occur within limits of mutual lattice dimensions and surface distortions. I. McA.

***X*-Ray diffraction patterns from crystalline substances at very high hydrostatic pressures.** R. B. JACOBS (Physical Rev., 1937, [ii], **51**, 999).—An apparatus for taking Debye–Scherrer *X*-ray spectrograms under hydrostatic pressures up to 4000 atm. has been constructed and used to follow crystallographic changes in KNO_3, $CsClO_4$, and AgI in the range 3000—4000 atm. At 3700 atm. and 25°, AgI has the NaCl type of cubic structure with a $6{\cdot}070\pm0{\cdot}010$ A., corresponding with ρ 5·72. L. S. T.

***X*-Ray measurement of the effect of temperature on the atomic vibrations in single crystals of zinc.** G. E. M. JAUNCEY and W. A. BRUCE (Physical Rev., 1937, [ii], **51**, 999). L. S. T.

Distortion of a closed shell due to crystallic fields. V. A. JOHNSON and L. W. NORDHEIM (Physical Rev., 1937, [ii], **51**, 1002).—Changes in charge distribution of the *M* shell in Zn due to fields of linear or tetrahedral symmetry have been calc. The distortion found is too small to account for the anomalies observed in the intensities of the electron diffraction pattern of ZnO (A., 1935, 1452), and other effects will have to be taken into account. L. S. T.

Fourier analysis of liquid methyl alcohol. G. G. HARVEY (Physical Rev., 1937, [ii], **51**, 998).—The *X*-ray diffraction curve of MeOH at $\sim -75°$ shows five diffraction rings. A Fourier analysis yields a radial electron distribution function which shows peaks more distinct than were formerly obtained (A., 1935, 572). Zachariasen's conclusions (*loc. cit.*) are confirmed. In addition, the present curve shows a definite peak corresponding with O–O linkings. L. S. T.

Röntgenographic study of collagens.—See A., 1938, III, 1019.

Crystal structure of pollucite and analcite.—See A., 1938, I, 644.

Crystal structure of talc and pyrophyllite.—See A., 1938, I, 644.

[Crystal structure of] melanophlogite.—See A., 1938, I, 644.

The three principal manners of crystallisation of metals and the conclusions to be drawn therefrom about the spheres of action of forces with cubic symmetry. R. REINICKE (Z. Instrumkde., 1938, **58**, 331—338).—The crystal structure of metals is interpreted on the assumption of a cubic region of action of at. forces. O. D. S.

Structure of liquid aliphatic amines. B. V. THOSAR (J. Chem. Physics, 1938, **6**, 654).—The *X*-ray diffraction of five dialkylamines (Pr^{α}, Pr^{β}, Bu^{α}, *n*- and *iso*-C_5H_{11}), of *n*-amylamine, and of triamylamine have been measured. The Bragg spacing for the dialkylamines is practically const. at 4·46 A. but from the diffuseness of the diffraction haloes it cannot represent the separation of the two C-chains in the same mol. and would appear to be the distance between two C-chains belonging to two adjacent mols. On the

assumption that the mols. are flat pyramids and in the cybotactic state, it is concluded that the liquid consists of these pyramids piled on top of each other. W. R. A.

Scattering of *X*-rays in liquid dialkylamines. B. V. THOSAR (Z. Physik, 1938, **110**, 436—442).—See preceding abstract. The const. K ($= d \times n^{1/3}$) does not lie in the region (0·8—1·0) required by the Raman theory for spherical mols., except in the case of $NHPr^{\beta}_2$. L. G. G.

Effect of an electric field on the diffraction pattern of liquids. A. A. BLESS (Physical Rev., 1937, [ii], **51**, 688).—Todd's experimental arrangement (A., 1934, 133) is criticised. Using the photographic method and maintaining the liquid at definite temp., no changes in the diffraction patterns of $PhNO_2$ or MeOH were produced by fields >10 kv. per cm. applied parallel or perpendicular to the direction of the *X*-ray beam. L. S. T.

Oxidation of zinc blende single-crystals studied by the aid of electron interference. G. AMINOFF and B. BROOMÉ (Kung. Svensk Vetensk. Hand., 1938, **16**, 3—12; cf. A., 1936, 958).—Oxidation of ZnS crystals yields a film of ZnO in which the *c* and *a* axes of the ZnO crystals are perpendicular to the tetrahedral faces and parallel to the tetrahedral edges, respectively, of the ZnS crystal. J. W. S.

Electron-diffraction investigation of sulphur monochloride, sulphur dichloride, sulphur trioxide, thionyl chloride, sulphuryl chloride, vanadium oxytrichloride, and chromyl chloride. K. J. PALMER (J. Amer. Chem. Soc., 1938, 60, 2360—2369).—Data recorded for interat. distances (in A.) and angles are: SCl_2, S—Cl 1·99±0·03, Cl—Cl 3·08±0·04, <Cl–S–Cl 101±4°; S_2Cl_2, S—Cl 1·99±0·03, S—S 2·05±0·03, <Cl–S–S 103±2°; $SOCl_2$, S—Cl 2·07±0·03, S—O 1·45±0·02, Cl—O 2·84±0·03, Cl—Cl 3·47±0·03, <Cl–S–Cl 114±2°, <Cl–S–O 106±1°; SO_2Cl_2, S—Cl 1·99±0·02, S—O 1·43±0·02, Cl—O 2·76±0·03, Cl—Cl 3·28±0·10, O—O 2·48±0·10, <Cl–S–Cl 111° 12′±2°, <O–S–O 119° 48′±5°, <Cl–S–O 106° 28′±2°; SO_3, S—O 1·43±0·02, O—O 2·48±0·03, <O–S–O 120±2°; $VOCl_3$, V—Cl 2·12±0·03, V—O 1·56±0·04, Cl—O 3·00±0·04, Cl—Cl 3·50±0·03, <Cl–V–Cl 111±2°, <Cl–V–O 108±2°; CrO_2Cl_2, Cr—Cl 2·12±0·02, Cr—O 1·57±0·03, Cl—O 3·03±0·03, Cl—Cl 3·54±0·05, O—O 2·49±0·10, <Cl–Cr–Cl 113±3°, <O–Cr–O 105±4°, <Cl–Cr–O 109±3°. SO_2Cl_2, $VOCl_3$, and CrO_2Cl_2 have considerably distorted tetrahedral configurations; $SOCl_2$ is pyramidal and SO_3 planar. S_2Cl_2 has 1 Cl attached to each S. E. S. H.

Structure of the PCl_5 molecule by electron diffraction. M. ROUAULT (Compt. rend., 1938, **207**, 620—622).—The theory of a method of calculating the intensity curve for electron diffraction in PCl_5 vapour is outlined. Assuming a trigonal bipyramidal mol. (A., 1937, I, 496), agreement with experimental intensities is obtained for P—Cl distances at the base and apices of 2·10 and 2·25 A., respectively. The min. Cl—Cl distance is 3·08 A., in agreement with the Cl—Cl distance in PCl_3 (cf. A., 1936, 272). A. J. E. W.

Electron-diffraction investigation of the structure of kaolin. Z. G. PINSKER (Acta Physicochim. U.R.S.S., 1938, **8**, 669—674).—Polemical. The conclusions of Schischakov (A., 1937, I, 502) on the electron diffraction of kaolin and related minerals are adversely criticised. W. R. A.

Electron interference in a convergent bundle. W. KOSSEL and G. MÖLLENSTEDT (Naturwiss., 1938, **26**, 660—661).—The interference pattern obtained with a convergent bundle of electrons after passing through a thin sheet of mica has been investigated, and the results are discussed. A. J. M.

Magnetic properties of nickel and nickel-rich alloys. T. HIRONE (Sci. Rep. Tôhoku, 1938, [i], **27**, 101—114).—A detailed account of work already noted (A., 1938, I, 182). W. R. A.

Paramagnetic dispersion in a single crystal. P. TEUNISSEN and C. J. GORTER (Physica, 1938, **5**, 855—856).—The paramagnetic susceptibility of a single crystal of Fe alum is the same when the magnetic field is parallel to the (1,0,0) plane of the crystals as when parallel to the (1,1,1) plane. J. W. S.

Magnetic anisotropies and the valencies of paramagnetic atoms in crystals. K. S. KRISHNAN and S. BANERJEE (Nature, 1938, **142**, 717).—The max. anisotropy at 31° of manganite crystals is 4×10^{-6} per g.-atom of Mn, showing that the Mn atoms in the crystal cannot be tervalent. They are probably half bivalent and half quadrivalent. L. S. T.

Structure of undeformed and simply deformed regions in liquid-crystalline films of considerable thickness. H. ZOCHER and G. UNGAR (Z. Physik, 1938, **110**, 529—548).—Supercooled liquid-cryst. films, 0·45 to 1·0 mm. thick, of *p*-acetoxybenzylideneazine and several other substances were examined in parallel and in convergent polarised light. The structure of the simply deformed areas in which there is no abrupt change in the orientation of the mols. through the film was elucidated with the aid of Oseen's differential equation. Interference figures obtained with convergent polarised light in the undeformed regions show that mol. orientation is perpendicular to the plane of the film and extends right through it. H. C. G.

Influence of deformation on the electrical conductivity of metals. E. LOPUCHIN (Tech. Phys. U.S.S.R., 1937, **4**, 25—35).—The elastic and plastic deformation of steels with varying amounts of C, and of Cu, Al, Zn, brass, and bronze, produce a continuous increase in their ohmic resistance. The sp. resistance increases constantly in the elastic and irregularly in the plastic region. The influence of a second metal is in agreement with the accepted theory of conductivity in metals. F. J. L.

Variation with heat-treatment of the cold-resistance of nickel. (MISS) B. RAINES (Physical Rev., 1938, [ii], **54**, 481—482).—Irregular variations of resistance at 0° (up to 17%) after heat-treatment over different temp. ranges and annealing for short and long periods are described. Results indicate that the wide divergencies of available data for the

electrical and thermal properties of Ni are due in part to the lack of a standardised ageing procedure. N. M. B.

Internal photo-electric effect in halochromatic crystals. G. GREGORETTI (Nuovo Cim., 1938, **15**, 193—208).—An account of the internal photo-electric effect in crystals, especially those of the alkali halides. O. J. W.

Paramagnetism of manganese. (MLLE.) A. SERRES (J. Phys. Radium, 1938, [vii], **9**, 377—380).—The effect of temp. on the paramagnetism of cryst. Mn has been investigated. In contradiction to the theory proposed by Néel (cf. A., 1936, I, 1188) the paramagnetism decreases slowly but continuously with increasing temp. in the range −183° to 600°. At lower temp. χ passes through a max., whilst at higher temp. it tends to a min. above 600°, probably at the temp. of the $\alpha \rightarrow \beta$ transition. No anomaly in the paramagnetism has been found near 350° to correspond with the observed anomaly in the sp. heat. W. R. A.

Irreversible and reversible changes of magnetisation in ferromagnetics under tension and mode of increasing magnetic field. E. KONDORSKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 117—120).—Two methods of working were used in which the rising and falling magnetising fields had (*a*) continually alternating sign, (*b*) no alternation of sign. These were applied to stressed and unstressed specimens. The latter gave identical results with both (*a*) and (*b*) but in the former case agreement is achieved only if the demagnetisation is carried out under tension with continually alternating fields. T. H. G.

Magnetic anisotropy of $CuSO_4,5H_2O$ in relation to its crystal structure. II. K. S. KRISHNAN and A. MOOKHERJI (Physical Rev., 1938, [ii], **54**, 533—539; cf. A., 1937, I, 20).—Previous results are extended and correlated in detail with crystal structure. Magnetic data are discussed in relation to the magnitude and asymmetry of the internal electric fields acting on the Cu^{++} ions in the crystal. A general method is described for determining, for any triclinic crystal, the principal magnetic axes and susceptibilities. N. M. B.

Diamagnetism of gaseous nitrosyl chloride. C. M. BEESON and C. D. CORYELL (J. Chem. Physics, 1938, **6**, 656—657).—Measurements by the Gouy method at 25° indicate that NOCl is diamagnetic and in a singlet state. W. R. A.

Collision excitation of intramolecular vibrations in gases and gas mixtures. V. Sound dispersion measurements in CO_2, CO_2–He, CO_2–H_2, and N_2O–He between 20° and 400°. L. KÜCHLER (Z. physikal. Chem., 1938, **B**, **41**, 199—214; cf. A., 1937, I, 504).—Sound dispersion measurements have been made in CO_2, and in CO_2–He, CO_2–H_2, and H_2O–He mixtures at various frequencies, pressures, and concns in the temp. range 20—400°. With increasing temp., the impulse output increases rapidly for CO_2–He, whilst it remains practically const. for CO_2–H_2 and N_2O–He. A parallelism between the abs. val. of the impulse output and its temp. coeff. is indicated. W. R. A.

Supersonic velocity in gases and vapours. I. Aberrations of supersonic interferometers in gases. S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **22**, **A**, 245—271).—An apparatus is described for recording the wave form in a supersonic interferometer, either photographically or directly on a Cambridge curve tracer. The results of other authors are discussed in relation to the curves obtained, and probable sources of errors are indicated. W. R. A.

Velocity of sound in liquid helium. J. C. FINDLAY, A. PITT, H. G. SMITH, and J. O. WILHELM (Physical Rev., 1938, [ii], **54**, 506—509).—The velocity of sound in liquid He under its v.p. was determined by an ultrasonic method for the temp. range 4·22—1·76° K., and compressibility was calc. At temp. not too close to the λ-point the vals. are in fair agreement with those estimated from thermodynamical considerations, but the expected discontinuity at the λ-transition was not observed. N. M. B.

Absorption and velocity of sound in hydrogen, deuterium, helium, and neon gases. A. VAN ITTERBEEK and L. THYS (Physica, 1938, **5**, 889—897).—The velocity and absorption coeff. (*a*) of ultrasonic waves in H_2, D_2, He, and Ne have been measured at −183° to 21°. *a* has ≫ the theoretical val., especially in the case of H_2. J. W. S.

Velocity of sound in gaseous argon and deuterium, respectively, at liquid oxygen and hydrogen temperatures. Calculation and discussion of the second virial coefficient of argon. A. VAN ITTERBEEK and O. VAN PAEMEL (Physica, 1938, **5**, 845—854).—Using ultrasonic waves, the velocity of sound has been determined at various pressures in A between 79° and 90° K., and in D_2 at 20° K. The second virial coeff. of A is calc. for temp. between 80° and 273° K. J. W. S.

Velocity of sound in copper. G. E. ALLAN (Phil. Mag., 1938, [vii], **26**, 609—614).—Since vals. published previously differ very considerably, measurements were made at 14·6° and 100° on a work-hardened Cu rod (99·9% Cu) by the monochord method. Velocity at 0° = 3852 m. per sec. and at 100° = 3815 m. per sec. By measurement of Young's modulus a velocity of 3852 m. per sec. at room temp. was obtained. Annealing the rod at 330° for 6 hr. reduced the velocity of sound by 3%. T. H. G.

Reflectivity and transparency of thin metallic films. K. KOLLER (Z. Physik, 1938, **110**, 661—675).—The reflexion and transmission of light during its passage through four different media are calc. The special case where one of the transparent substrata is not plane parallel is also considered. A new formula, free from certain deficiencies of the Goldschmidt formula, and applicable to all cases, is illustrated with reference to thin films of Ag and Au. H. C. G.

Thermal properties of crystals at low temperatures. A. GOETZ (Nuovo Cim., 1938, **15**, 158—159).—A summary. O. J. W.

Heat capacity of bismuth from −80° to 120°. H. L. BRONSON and L. E. MACHATTIE (Canad. J. Res., 1938, **16**, A, 177—182).—The mean C_p of Bi over 10° intervals has been determined from −80° to 120° by adiabatic electrical heating in a Cu jacket. A smooth curve was obtained, fitted within the limits of experimental error by $C_p = 0{\cdot}1238_5 + 4{\cdot}45 \times 10^{-5}\theta$ joules (θ = °C.), but more closely by $C_p = (1/209)D(119/T) + 3{\cdot}99_7 \times 10^{-7}T^{1{\cdot}703}$ joules, $D(119/T)$ being the Debye function for C_v. The vals. of C_p calc. from non-thermal data at 30° and 75° are ~3% lower than observed vals., a discrepancy considered to be due to the need for another term in the expression used to calculate C_p or to the invalidity of the assumption of harmonic oscillations in the crystal lattice for Bi at room temp. F. H.

Specific heat of "Lucite" (methyl methacrylate polymeride). F. T. GUCKER, jun., and W. L. FORD (J. Amer. Chem. Soc., 1938, **60**, 2563).—The sp. heat is 0·343±0·005 g.-cal. per degree per g. "Lucite" is a useful substitute for glass as an insulator in calorimetry. E. S. H.

Specific heats and heat of fusion of tellurium tetrachloride. K. J. FREDERICK and J. H. HILDEBRAND (J. Amer. Chem. Soc., 1938, **60**, 2522—2523).—Data recorded are: heat of fusion at m.p. 4510±30, heat capacity of solid (25—224·1°) 33·1±0·3, heat capacity of liquid (224·1—265°) 55·0±0·5 g.-cal. per mol. E. S. H.

Low-temperature thermal measurements on some fluorides (BF_3, CF_4, and SF_6). A. EUCKEN and E. SCHRÖDER (Z. physikal. Chem., 1938, **B**, **41**, 307—319).—Data for the mol. heat and the heats of transformation and of fusion are recorded. The transformation temp. and m.p. (° K.) are respectively CF_4 76·23°, 89·47°; BF_3 142·15°, 144·46°; SF_6 94·3°, 222·5°. The calc. entropies agree in the case of BF_3 and SF_6 with vals. calc. statistically, and the difference between the two vals. in the case of CF_4 is ascribed to experimental errors. C. R. H.

Methyl bromide. Heat capacity, vapour pressure, heats of transition, fusion, and vaporisation. Entropy and density of the gas. C. J. EGAN and J. D. KEMP (J. Amer. Chem. Soc., 1938, **60**, 2097—2101).—Heat capacities from 15° K. to the b.p. are recorded. MeBr has a transition point in the solid state at 173·75±0·15° K., m.p. 179·44±0·05° K., b.p. 276·66±0·05° K., heat of transition 113·4±1 g.-cal. per mol., heat of fusion 1429±2 g.-cal. per mol., heat of vaporisation 5715±6 g.-cal. per mol., v.p. of liquid (203—278° K.) $\log_{10} P_{(\text{Int. cm. Hg})} = -(1541{\cdot}437/T) + 8{\cdot}49274 - 0{\cdot}00424740T + 1{\cdot}7599 \times 10^{-6}T^2$, d of gas at 298·10° K. and 1 atm. 3·9739±0·0009 g. per l. The entropy of the ideal gas at the b.p. and 1 atm., calc. from calorimetric data, is 57·86±0·10 g.-cal. per degree per mol. The experimental entropy at 298·10° K. is 58·61 and the spectroscopic val. 58·74 g.-cal. per degree per mol. E. S. H.

B.p. and chemical constitution. II. Method of calculating degree of association at the b.p. V. C. E. BURNOP (J.C.S., 1938, 1614—1618).—The additive function $(b) = M\log T + 8{\cdot}0(M)^{\frac{1}{2}}$ connecting the abs. b.p. (T) and the mol. wt. (M) previously obtained (A., 1938, I, 393) is used to calculate the b.p. T' which an associated compound should have in the unassociated state. Using Walker's generalisation that the mol. wts. of related compounds ∝ squares of their abs. b.p., $(T/T')^2$ is regarded as giving the degree of association. The vals. obtained for some alcohols, phenols, acids, amides, nitriles, and amines are given. Among isomeric alcohols the primary has the highest, and the *tert.* the lowest, degree of association. The val. for HF is 3·46, and for H_2O 6·7, at respective b.p. A. J. M.

Persistence of the liquid state of aggregation above the critical temperature. R. L. MCINTOSH and O. MAASS (Canad. J. Res., 1938, **16**, **B**, 289—302; cf. A., 1937, I, 506).—Redetermination of abs. density of C_2H_4 in the crit. temp.–crit. pressure region has shown that previous vals. were too large by a const. factor of 0·0100 g. per c.c. In agreement with predictions made from calculations based on statistical mechanics, the pressure of the system remained const. over a considerable variation of mass/vol., at a temp. just above that at which the meniscus disappeared. The complete hysteresis curve of C_2H_4 at const. vol. has been determined for the first time. With air–C_2H_4 mixtures, similar isobars were obtained as with pure C_2H_4, but the isochores differed. F. H.

Critical phenomena. W. ŚWIĘTOSŁAWSKI (Bull. Acad. Polonaise, 1938, **A**, 304—315).—The large discrepancies found between vals. of the crit. temp. and pressure of liquids determined by observing (i) the disappearance of the meniscus of the liquid contained in a capillary, and (ii) the appearance of a mist in the capillary, show that the crit. state of a liquid is not well defined by (i) or (ii). A new comparative method is therefore suggested in which the crit. consts. of a liquid are obtained by comparison with those of standard liquids, and an apparatus is described by which the crit. consts. of the standards can be accurately determined. W. R. A.

Critical temperature. I. TRAUBE (Trans. Faraday Soc., 1938, **34**, 1234—1235).—A review of recent work supporting the author's contention that liquid and vapour ("liquidogenic" and "gasogenic" mols.) can co-exist above the classical crit. temp. F. L. U.

Polymorphism. IV. Linear velocity of polymorphic transformation of mercuric iodide. D. G. EADE and N. H. HARTSHORNE (J.C.S., 1938, 1636—1646).—The linear velocity of the interface between red and yellow HgI_2 (transition temp. 127°) has been determined directly in thin polycryst. films. From 0° to 40° the interface starts preferentially at the edges of the film, and the linear distance, s, moved by the interface in time t is given very nearly by $t = k_1s^2 + k_2s$, k_1 and k_2 being consts. This equation may also be deduced theoretically from considerations of diffusion. The apparent activation energy between 0° and 30° is about 10,000—11,000 g.-cal., a val. ≪ the internal latent heat of sublimation of either form. At 130° the transformation red → yellow occurs mainly by the growth of nuclei of the yellow form in the interior of the film, and the rate varies considerably from film to film. A. J. M.

Crystallisation in transparent films from the molten state. Case of a single crystallisable substance, growth and dissolution of crystals, effects of heterogeneous addenda. J. SEIGLE (Chim. et Ind., 1938, **40**, 419—433).—Technique for crystallising substances of low m.p. (especially org. compounds) in thin films with a controlled rate of cooling is described, and the main types of crystallisation so produced are classified. Observations on the progress of crystallisation and the effects produced by air bubbles and solid or liquid particles are reported. E. S. H.

Crystal nuclei. C. HAMMER (Ann. Physik, 1938, [v], **33**, 445—458).—The no. of nuclei in a supercooled melt of piperonal rises to a saturation val., n, with increasing time of cooling. Empirical formulæ are given for the variation of n in any one melt with time and temp. of melting. An electrophoresis of the nuclei in the melt is described. The influence of static and alternating electric fields on n has been investigated. Results support the theory of Meyer and Pfaff (A., 1935, 1449) that the nuclei are formed from foreign inclusions. O. D. S.

Crystallisation nuclei in water. V. J. ALTBERG (Acta Physicochim. U.R.S.S., 1938, **8**, 677—678).—The shape and rate of growth of crystallisation nuclei in H_2O are discussed. W. R. A.

Physical chemical properties of *cis*- and *trans*-decahydronaphthalene. W. F. SEYER and R. D. WALKER (J. Amer. Chem. Soc., 1938, **60**, 2125—2128).—The *cis*-form has d_4^{20} 0·8963, n_D^{20} 1·48113, f.p. −43·26±0·04°, b.p. 194·6°; the *trans*-form has d_4^{20} 0·8699, n_D^{20} 1·46968, f.p. −31·47±0·04°, b.p. 185·5°. Vals. for d and n of nine mixtures of the two forms are related linearly to composition. E. S. H.

Physical constants of *cis*-Δ^{β}-pentene. M. L. SHERRILL and E. H. LAUNSPACH (J. Amer. Chem. Soc., 1938, **60**, 2562—2563).—A product of const. properties has been obtained by fractional distillation: b.p. 37·0±0·05°, n_D^{20} 1·3822, d_4^{20} 0·6562. E. S. H.

Condensation coefficients of mercury halides. F. METZGER and E. MIESCHER (Nature, 1938, **142**, 572).—Vals. obtained are $HgCl_2$ 0·76, $HgBr_2$ 0·64, and HgI_2 0·53 (all ±0·1). Owing to uncertainty in the extrapolated vals. of the saturated v.p., the condensation coeffs. may, however, be close to 1, showing that each mol. striking the cold solid surface condenses at once. L. S. T.

Low-temperature transitions of ND_4Br. I. A retrograde transition. A. SMITS, D. TOLLENAAR, and F. A. KRÖGER (Z. physikal. Chem., 1938, **B**, **41**, 215—235).—ND_4Br was prepared according to the reaction $8ND_3 + 3Br_2 \rightarrow 6ND_4Br + N_2$ and its low-temp. transitions were measured dilatometrically. The transition from tetragonal to cubic modifications, occurring for NH_4Br at −39° with a hysteresis range of 0·06°, appears in ND_4Br at −58° and a range of 0·15° of hysteresis. The characteristics of the hysteresis curves for both analogues are similar. The change in mol. vol. for NH_4Br is 0·06 and for ND_4Br 0·17 c.c. A second transition point (cf. Clusius, A., 1938, I, 239) for the transformation from the tetragonal to a regular modification occurs at −114° to −105° (hysteresis range of 9°) and the change in mol. vol. is 1·08 c.c. *X*-Ray investigations at different temp. indicate the existence of two cubic forms above and below the range of the tetragonal modification. These two forms have a CsCl-like structure and are completely identical. The results are discussed from the point of view of the existence of a retrograde transition and this is extended to existing data on some other pairs of isotopic analogues. W. R. A.

Thermal expansion of liquids. J. WEICHHERZ (Acta Physicochim., U.R.S.S., 1938, **8**, 503—512).—A generalised form of the Mendeleev equation, $v = v_0/(1 - kt)$, for the thermal expansion of liquids has been deduced, and from this it has been shown that the product $(v - v_\infty)(t - t_\infty)$ must be a const. for each liquid. Test data show that the vals. obtained for this product are accurately const. for Hg, CS_2, Et_2O, n-C_5H_{12}, and, to a smaller extent, for EtOH. L. S. T.

Ponderomotive effect associated with the flow of heat through liquid helium II. H. LONDON (Nature, 1938, **142**, 612—613).—Investigation of liquid He II with a modified, immersed Knudsen manometer showed an attraction of the vane to the fixed plate instead of the expected repulsion. This may indicate that in He II the heat flow is associated with a flow of liquid. L. S. T.

Inner friction and heat conductivity of nuclear material. S. TOMONAGA (Z. Physik, 1938, **110**, 573—604).—Theoretical. The viscosity and conductivity of nuclear material are calc. on the basis of the Fermi gas model, and at low temp. $\propto 1/T^2$ and $1/T$, respectively. η is so great that an oscillation of nuclear material at low temp. is always aperiodically damped and at. nuclei can only retain their excitation energy as heat. Conductivity is also shown to be high. L. G. G.

Effect of magnetic field on the thermal conductivity of nitric oxide and nitrogen peroxide. H. TORWEGGE (Ann. Physik, 1938, [v], **33**, 459—470).—The effect of magnetic field on the thermal conductivity of NO is exactly analogous to the O_2 effect (A., 1933, 559). The max. val. of the alteration in k is 0·8% and requires a greater field to produce it than the saturation field for O_2. The ratio of the saturation effects of O_2 and NO is 1·5, *i.e.*, approx. the ratio of their magnetic moments. A normal effect in NO_2 is complicated by an unexplained secondary effect. O. D. S.

Influence of magnetic field on the viscosity of gases. Nitric oxide. H. SENFTLEBEN and H. GLADISCH (Ann. Physik, 1938, [v], **33**, 471—476; cf. A., 1938, I, 73).—The effect for NO is similar to that for O_2. The ratio of the effects for O_2 and NO is equal to the ratio of the conductivity effects (cf. preceding abstract). O. D. S.

Compressibilities of hydrogen and of four mixtures of hydrogen and nitrogen at 0°, 25°, 50°, 100°, 200°, and 300°, and to 1000 atmospheres. R. WIEBE and V. L. GADDY (J. Amer. Chem. Soc., 1938, **60**, 2300—2303).—Modified apparatus is described and data are recorded for the range stated. E. S. H.

Elastic constants of transparent solids by a new method. C. SCHAEFER and L. BERGMANN (Z. Physik, 1938, **110**, 763—764).—A criticism of Hoesch (cf. A., 1938, I, 504) L. G. G.

Viscosity of helium. E. A. UEHLING and E. J. HELLUND (Physical Rev., 1938, [ii], **54**, 479).—Recent experimental data (cf. Itterbeek, A., 1938, I, 304) are discussed in relation to the inadequacy of the elastic sphere at. model and to the choice of van der Waals interaction field. The Lennard-Jones form of field (cf. *ibid.*, 22) gives satisfactory results at high and low temp. N. M. B.

Flow phenomena in liquid helium II. J. F. ALLEN and A. D. MISENER (Nature, 1938, **142**, 643—644; cf. A., 1938, I, 131).—The flow through capillaries of radius 6×10^{-5} to 0·05 cm. and through tubes filled with tightly-packed rouge has been further investigated. In capillaries longer than 15 cm. the rate of flow depends only slightly on the pressure head. The smaller is the cross-sectional area of a capillary the less dependent on the pressure head does the velocity become, and with the finest capillaries flow becomes independent of head for pressures from 0 to 200 dynes. The pressure-independent velocity increases rapidly between 2·177 and 1·15° K. Under experimental conditions similar to those used by Burton (A., 1938, I, 446) no purely laminar flow was observed. L. S. T.

Coefficient of viscosity of air. V. D. MAJUMDAR and M. B. VAJIFDAR (Proc. Indian Acad. Sci., 1938, **8**, **A**, 171—178; cf. A., 1936, 1454).—Improved apparatus gives vals.: η, $1834{\cdot}38 \pm 0{\cdot}35 \times 10^{-7}$ c.g.s. unit at 23°, electronic charge, corr. from Millikan's val., $4{\cdot}816 \times 10^{-10}$ e.s. unit. O. D. S.

Viscosities of hydrocarbons. VII, VIII. E. B. EVANS (J. Inst. Petroleum Tech., 1938, **24**, 537—553; cf. A., 1938, I, 508).—Data on the viscosities of 19 monocyclic aromatic and 62 polycyclic hydrocarbons have been collected and correlated. New vals for $PhPr^{\alpha}$ and $PhBu^{\alpha}$ and for 15 polycyclic compounds are recorded. The data are of importance in relation to the composition and properties of lubricating oil fractions but owing to high m.p. correlation of some of the data has involved considerable extrapolation. Vals. of b.p., m.p., *d*, and *n*, and details of prep. are given for the less common compounds. T. H. G.

Viscosity measurements on homologous series of esters with special regard to the relationship of Thorpe and Rodger. O. ALBERT (Z. physikal. Chem., 1938, **182**, 421—429).—The viscosities (η) and densities of oleic, nonenoic, nonoic, and cinnamic acids and a no. of their esters have been determined at 20°, 25°, 100°, and 180°. The mol. refractions and mol. dispersions of most of these compounds have also been calc. The relationship $T = A/\eta + c$, where A and c are consts., holds for the esters, but for acids which are associated holds only at higher temp. At higher temp. in each series log η varies linearly with the mol. wt., but at lower temp. deviations are observed. The Thorpe–Rodger relationship (Phil. Trans., 1894, **185**, 397) holds well for the series of esters, but the acids, owing to association, show rather divergent results. J. W. S.

Viscosity function. E. P. IRANY (J. Amer. Chem. Soc., 1938, **60**, 2106—2115).—Application of graphical analysis to a large amount of published data reveals fundamental regularities. Three functions of η are recognised, which are generally additive in terms of vol., temp., and pressure respectively. If η is plotted in these functional scales, deviations from a straight line indicate "non-ideal" conditions, such as associative or dissociative tendencies which could not be detected by other means. Conclusions regarding state discontinuity are reached as a result of extrapolation into the crit. region. The pressure functional scale shows the correct magnitude of the internal pressures of liquids, which are characteristic for series of related substances. E. S. H.

Effect of a magnetic field on the viscosity of the anisotropic liquid *p*-azoxyanisole. V. N. ZVETKOV and G. M. MICHAILOV (Acta Physicochim. U.R.S.S., 1938, **8**, 77—94).—The viscosity was investigated under conditions for which Poiseuille's law held. With a magnetic field (up to 10^4 gauss) normal to the direction of flow an increase of viscocity as much as 100% was obtained. The increase was greater for small rates of flow and disappeared with $v > 7{\cdot}4$ cm. per sec. This explains discrepancies of previous workers. The effect decreased with temp., becoming zero at 135° (transition temp., anisotropic → isotropic liquid). A parallel magnetic field caused a decrease of viscocity but of smaller magnitude than with the normal field. J. A. K.

Application of the formulæ of Le Chatelier and of Vogel, Fulcher, and Tammann to the viscosity of strongly associated liquids at different temperatures. B. DERJAGUIN and M. KUSSAKOV (Acta Physicochim. U.R.S.S., 1937, **7**, 459—466).—Twelve motor oils have been examined over the temp. range 0—140° and the results are in accord with the formulæ referred to in the title. W. R. A.

Molecular viscosity of liquids. S. I. VAVILOV (Acta Physicochim. U.R.S.S., 1937, **7**, 49—64).—Theoretical. A distinction is made between mol. viscosity and the macroscopic viscosity used in hydrodynamical formulæ, and between the effective particle radius of the formulæ and the gas-kinetic radius of the mol. Vals. of the effective radius and mol. viscosity have been calc. from published data. E. S. H.

Connexion between streaming double refraction and structural viscosity. W. BUCHHEIM and W. PHILIPPOFF (Naturwiss., 1938, **26**, 694—695).—The streaming double refraction and structural η of solutions of cellulose nitrate (1·08—0·77%) in *cyclo*hexanone have been determined. The increase in double refraction (Δn) $\propto dv/dn$ (v = velocity). Δn is not directly connected with the orientation angle (χ) or with η. χ decreases with increasing dv/dn. A. J. M.

Quantitative connexion between elastic properties and viscosity of liquids. W. KUHN (Naturwiss., 1938, **26**, 661—662).—A quant. relationship between the viscosity and the modulus of elasticity

and relaxation time of a liquid is obtained. It gives satisfactory agreement with experiment in the case of a polystyrene glass of mol. wt. 63,000. A. J. M.

Regular gas solutions. I. R. KRITSCHEVSKI (Acta Physicochim. U.R.S.S., 1938, **8**, 641—646).—Mathematical. A kinetic equation has been derived expressing the P–V–T dependence of regular gas solutions, which includes the Bartlett rule (cf. A., 1928, 698) as a special case. W. R. A.

Unusually high solubility of nitrogen and oxygen in certain metals, particularly zirconium and titanium. J. D. FAST (Metallwirts., 1938, **17**, 641—644).—Recent research, particularly of the author and his collaborators, is reviewed. C. E. H.

Solubility of hydrogen in manganese–iron alloys. W. BAUKLOH and R. MÜLLER (Arch. Eisenhüttenw., 1937—8, **11**, 509—514).—The adsorptive power of Fe for H_2 decreases sharply with addition of Mn up to 0·2%; with more Mn the solubility of H_2 in steel increases sharply up to a max. at 7·2% Mn, then decreases just as sharply to a const. val. between 10 and 17% Mn, after which it increases almost linearly to a high val. at 35% Mn. Alloys with 19·6—23·7% Mn show a slight min. in H_2 solubility at 500—700°. The reduction in the solubility of H_2 at high temp. in alloys with >7% Mn is ascribed to the lower solubility of the gas in the hexagonal ε-phase which exists above 200°. A. R. P.

Influence of magnetic and electric fields on anisotropic liquid mixtures. V. ZVETKOV (Acta Physicochim. U.R.S.S., 1937, **6**, 865—884).—A thin layer of an anisotropic liquid mixture of *p*-azoxyanisole (I) and methoxycinnamic acid (II), and certain other mixtures of isomorphic liquid crystals, gives good normal orientation. The effects of magnetic and electric fields on mixtures of (I) and (II) have been studied. W. R. A.

Liquid precipitations. Application of the theory of coacervation to electrolytes. H. PIRENNE (Rev. Univ. Mines, 1937, **13**, 227—228).—In a supersaturated salt solution separation of a new liquid phase more conc. than the mother solution is possible. This phenomenon occurs only in the case of mols. which contain at least one multivalent ion and in which the difference in sign between the ions is very great. The phenomenon can be explained on the basis of the coacervation theory. R. B. C.

Freezing-point diagram of the system *n*-hexadecane–*n*-Δ^a-hexadecene [cetene]. S. L. LANGEDIJK and W. C. B. SMITHUYSEN (Rec. trav. chim., 1938, **57**, 1050—1054).—*n*-Δ^a-$C_{16}H_{32}$ freezes at 4·068° and *n*-$C_{16}H_{34}$ at 17·830°. The f.-p. diagram is very nearly a straight line and the solid phases are solid solutions containing slightly more of $C_{16}H_{34}$ than the mother-liquor. F. J. G.

Stabilisation of cuprammonium ion in aqueous solution. P. G. PATERNOSTO (Rev. Fac. Cien. Quím. La Plata, 1936, **11**, 11—15).—The stability of solutions of $Cu(NH_3)_4SO_4,H_2O$ increases with concn. 0·4M. solutions are stable for 2 years. F. R. G.

Hypoiodous cations, and their action on an organic reagent. I. MASSON (J.C.S., 1938, 1708—1712).—The brown solutes formed by adding I to solutions of I_2O_5 or I_2O_3,SO_3 in conc. H_2SO_4 have compositions ranging from $I_{2\cdot8}O$ to $I_{8\cdot5}O$ according as the acid is near H_2SO_4,H_2O or nearer H_2SO_4. The solutes react rapidly with PhCl, normally according to $2PhCl + 3I_xO \rightarrow 2C_6H_2ClI_3 + 3I_{x-2}$. At least three isomerides, mainly unsymmetrical, of $C_6H_2ClI_3$ are formed, including one which is new with m.p. 147°. The iodinations prove that the effective I in the brown solutes is univalent, on account of the absence of all but traces of iodonium products which would be expected if the tervalent (iodous) radical had been the active agent. The traces are ascribed to the reversibility of the reaction: iodous radical + $I_2 \rightleftharpoons$ brown solute. Possible mechanisms are discussed. C. R. H.

Complex structure of tartar emetic. P. DUQUÉNOIS (Compt. rend., 1938, **207**, 570—571).—Ion transport experiments show that the Sb in aq. $KSbOC_4H_4O_6$ occurs in a complex anion at p_H 3·8—7·2, and as a cation at $p_H < 3·7$. Colloidal suspensions are formed at $p_H > 6·0$ or $< 2·0$. Isoelectric points occur at p_H 3·8 and $< 1·4$ (?), with a neutral point of the second kind at p_H 1·7; the aq. solution has p_H 3·8. A. J. E. W.

Theory of binary metallic mixed phases. G. MOLIÈRE (Metallwirts., 1938, **17**, 650—654).—A crit. review of recent developments is given. C. E. H.

Transition temperatures of superconductive alloys. H. JONES (Nature, 1938, **142**, 611).—The change in transition temp. of superconductors which results when small amounts of other metals are added in solid solution is due largely to change of entropy in the normal state of the metal. The entropy of the superconducting phase is relatively little affected by the additions. L. S. T.

***X*-Ray investigation of slowly cooled copper–nickel–aluminium alloys.** A. J. BRADLEY and H. LIPSON (Proc. Roy. Soc., 1938, **A**, **167**, 421—438).—The phase boundaries of the ternary diagram are determined from powder photographs of the alloys, the relative intensities of the *X*-ray reflexions being used to estimate the proportions of the constituents in the two- and three-phase fields. The single phases of the system are all derived from those occurring in the Cu–Al and Ni–Al systems, with the exception of one, of composition Cu_3NiAl_6, which has a new type of structure derived from a deformed body-centred cube. G. D. P.

Structure of age-hardened aluminium–copper alloys. (A) A. GUINIER. (B) G. D. PRESTON (Nature, 1938, **142**, 569—570, 570).—(A) *X*-Ray diagrams of Al–Cu (5% Cu) alloys age-hardened at 25—200° show streaks of different size and weak intensity, and spots of very weak intensity (A., 1938, I, 389), which are attributed to diffraction by a two-dimensional lattice.

(B) A similar effect, observed in the Laue photographs during the age-hardening of an alloy of Al with 4% of Cu, is discussed. L. S. T.

System indium–lead. S. VALENTINER and A. HABERSTROH (Z. Physik, 1938, **110**, 727—741).—Thermal aud *X*-ray analysis show that the system In–Pb does not form a continuous series of mixed crystals. On the Pb-rich side of the system mixed crystals are formed in which In atoms replace Pb atoms in the crystal lattice, the const. of which increases with increasing In content. Below 30 at.-% Pb a tetragonal face-centred crystal corresponding with $In_{26}Pb_6$ separates at 172°, with a 4·87 A. At lower Pb contents this gives place to $In_{30}Pb_2$, an In-type crystal separating at 159°, with a 4·59 A. L. G. G.

Alloys of silver and iron.—See B., 1938, 1305.

System iron–zinc. H. BABLIK, F. GÖTZL, and F. HALLA (Z. Metallk., 1938, **30**, 249—252).—Small hexagonal bipyramidal crystals isolated from the "hard Zn" crust at the bottom of a galvanising kettle contained 7—9% Fe and had d 7·25; they were identified as Schramm's δ_1-phase and belonged to the space-group C_{6v}^4 or D_{6h}^4. Their lattice consts. were a 12·80, c 57·6 A., indicating about 550 atoms per unit cell, which is therefore the greatest so far identified in intermetallic compounds. A. R. P.

Electrical conductivity and equilibrium diagram of binary alloys. XXIV. Alloys of barium with bismuth, magnesium, and lead. G. GRUBE and A. DIETRICH (Z. Elektrochem., 1938, **44**, 755—767; cf. A., 1938, I, 449).—Temp.-resistivity curves have been determined for various Ba–Bi, Ba–Mg, and Ba–Pb alloys, and the equilibrium diagrams for these systems deduced. The compounds $BaPb_3$, m.p. 617°, and Ba_2Pb, m.p. 928°, have been detected, as well as the compounds $BaBi_3$, $BaMg_9$, and BaPb with incongruent m.p. In the system Ba–Mg two other phases appear, apparently $BaMg_4$ and Ba_2Mg_5, with incongruent and congruent m.p., respectively. BaPb exists in α- and β-forms (transition temp. 546°). Ba_2Pb forms mixed crystals with BaPb and Ba over limited ranges of concn. Solid Pb dissolves small amounts of Ba, which cause a considerable increase in its age-hardening at room temp. Additions of Ba cause considerable increases in the hardness of all three metals. J. W. S.

Some cadmium–copper–zinc alloys with a high cadmium content. G. G. MONSELISE (Chim. e l'Ind., 1938, **20**, 594—596; cf. B., 1938, 797).—Thermal investigation of alloys containing up to 50% Zn and 10% Cu indicates the existence of a ternary eutectic, m.p. 258°, of the composition Cd 83·30, Cu 0·70, and Zn 15·90%. Photomicrographs are reproduced. O. J. W.

Alloys of the schreibersite type. H. NOWOTNY (Naturwiss., 1938, **26**, 631).—Schreibersite, occurring in meteors, is $(Fe,Ni,Co)_3P$, and is isomorphous with Fe_3P. The formation of mixed phosphides of Cr and Mn, and their *X*-ray structure, have been investigated. Alloys of the types $(M^I_{0·5}M^{II}_{0·5})_3P$ and $(M^I_{0·75}M^{II}_{0·25})_2P$ were examined with the pairs Cr–Mn, Cr–Fe, Cr–Ni, Cr–Cu, Mn–Fe, Mn–Ni, Mn–Cu, Fe–Ni, Fe–Cu, Ni–Cu. All show a homogeneous M_3P phase. Lattice consts. of the tetragonal cell are given. A. J. M.

System iron–manganese–silicon. (A) E. JÄNECKE. (B) R. VOGEL (Arch. Eisenhüttenw., 1937—8, **11**, 409—411, 411—412).—Polemical. The interpretation of some of the results of Vogel and Bedarff (A., 1937, I, 133) is disputed. A. R. P.

Iron corner of the aluminium–carbon–iron system. K. LÖHBERG and W. SCHMIDT (Arch. Eisenhüttenw., 1937—8, **11**, 607—614).—The equilibrium relations in this system are determined by the formation of a ternary Al–Fe–C compound (κ) of unknown composition; this carbide is ferromagnetic and has a cubic face-centred lattice with superstructure, a 3·719—3·780 A. The austenite field extends to 1·35% C with 11·5% Al and 2·35% C with 12% Al. There is a plane of four-phase equilibrium at 1297°: liquid (Al 12, C 2·55%) + α (Al 20, C 0·08%) = γ (Al 11·5, C 1·35%) + κ, a second at 1290°: liquid (Al 9, C 3%) + κ = graphite (or Fe_3C) + γ (Al 10, C 2·35%), and a third at 730°: $\gamma \rightleftharpoons \alpha + \kappa +$ graphite or $\gamma + \kappa \rightleftharpoons \alpha +$ graphite. In alloys with a relatively high C content graphite occurs only when a small amount of κ is present, and up to 4% Al therefore promotes separation of graphite. Between 8 and 18% Al little graphite is formed but with 18—20% Al large amounts separate. A. R. P.

System iron–chromium–chromium sulphide–iron sulphide. R. VOGEL and R. REINBACH (Arch. Eisenhüttenw., 1937—8, **11**, 457—462).—Cr and CrS form a eutectic at 1350°, 32·5% S; CrS melts at 1565°, is practically insol. in solid Cr, and dissolves in liquid Cr to the extent of 2·2% S at 1560°. FeS and CrS form a continuous series of solid solutions. In the Fe–Cr–CrS–FeS system there is a very wide miscibility gap in the liquid state, and in the solid state only two phases are present; these solidify in the region of this gap in two layers, a Cr-rich sulphide and an Fe-rich metal layer. Numerous pseudobinary diagrams for various const. Fe/Cr ratios and a complete ternary diagram between the Fe–Cr side and the FeS–CrS line are given. A. R. P.

Electron-optical observations on twinning in nickel-iron. W. G. BURGERS (Metallwirts., 1938, **17**, 648—650).—The progress of twinning during the recrystallisation of rolled Ni–Fe sheet has been followed by means of the electron emission microscope, and the observations are discussed in relation to the theory of Carpenter and Tamura (A., 1927, 10, 191). C. E. H.

Alloys of iron with metals of the platinum group. M. FALLOT (Ann. Physique, 1938, [xi], **10**, 291—332; cf. A., 1937, I, 229).—Alloys of Fe with Pt, Ir, Os, Ru, Rh, and Pd were prepared over the ferromagnetic concn. range. Range limits were determined and the influence of concn. of added metal on Fe transitions is shown graphically. Phase changes were investigated by the determination of Curie points and transitions, and confirmed by *X*-ray studies. Ferromagnetic moments were found, and data for the variation of mean at. moment are reported. N. M. B.

Crystal structures of the iron–palladium superlattices. R. HULTGREN and C. A. ZAPFFE (Z.

Krist., 1938, **99**, 509—512; cf. Hocart and Fallot, A., 1937, I, 357).—*X*-Ray analysis of the Fe–Pd system has yielded complete structures for the FePd and $FePd_3$ phases. In both, at. vol. increases with ordering; the upper temp. limits of stability increase with excess of [Pd] and [Fe], respectively. $FePd_3$, face-centred cubic, *a* 3·837—3·840 A., is like $AuCu_3$. FePd (48·1 at.-% Fe) is cubic if the quenching temp. is >700°, tetragonal if ≯650°. The normal tetragonal cell has *a* 3·852, *c* 3·723 A. *c*/*a* increases with temp. and with fall in [Pd]. I. McA.

Emulsoid state of binary liquid systems above the critical miscibility temperature. J. Frenkel (Acta Physicochim. U.R.S.S., 1938, **8**, 261—270).—Since many binary liquid mixtures, even above the crit. miscibility temp. T_c, exist as highly disperse emulsions, T_c is defined as the temp. at which the surface tension, γ, between the two saturated mol. solutions of different composition, vanishes. γ then remains approx. at zero with further increase in temp., due to gradual emulsification of the system, until it disappears at the true (mol.) miscibility temp. W. R. A.

Estimation of deuterium oxide–water mixtures. II. Solubility curves with *n*- and *iso*-butyric acid. W. H. Patterson (J.C.S., 1938, 1559—1561).—The mutual miscibility–temp. curves given severally by these two acids have been traced for various H_2O–D_2O mixtures. An inclined straight line joins the max. of the curves. A simple method for determining the D_2O content of heavy H_2O, by gradual addition of one of the acids until opalescence is observed, is described. C. R. H.

Solubility of some sparingly soluble silver salts. C. Bedel (Compt. rend., 1938, **207**, 632—634; cf. A., 1937, I, 407).—Solubilities at 20° are: AgCl, $4·4 \times 10^{-4}$; AgBr, $3·5 \times 10^{-7}$; AgI, $3·4 \times 10^{-9}$ g. per l.; solubilities at 40°, 60°, and 80° are also given. AgBr is more sol. in Hg^{II} salt solutions, indicating complex formation. A. J. E. W.

Solubility of calcium bicarbonate. S. S. Hubard (J. Physical Chem., 1938, **42**, 971—972).—Aq. $Ca(OH)_2$ saturated with CO_2 has been shown to diffuse through collodion membranes. It is inferred that the Ca passes into true solution as $Ca(HCO_3)_2$. J. W. S.

Measurement of solubilities of thallous bromide and iodide by the polarographic method. Y. Terui (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 595—601).—Solubilities in aq. solution of the corresponding K halides, measured at 25°, and the calc. solubility products, are tabulated. N. M. B

Solubility of halides in anhydrous acetic acid. A. W. Davidson and W. Chappell (J. Amer. Chem. Soc., 1938, **60**, 2043—2046).—Data are recorded for $CuCl_2$, NaCl, NH_4Cl, KCl, $SrCl_2$, $HgCl_2$, $HgBr_2$, and HgI at approx. 25—100° and for $BaCl_2$ at 30° and 45°. $SrCl_2$ exhibits retrograde solubility. The *solvate* $HgCl_2$,2AcOH has been isolated. E. S. H.

Solubility of amino-acids in acetic and butyric acid. S. J. von Przyłęcki and K. Kasprzyk-Czaykowska (Biochem. Z., 1938, **298**, 328—329; cf. A., 1937, II, 172).—The solubilities of proline, hydroxyproline, serine, methionine, tryptophan, phenylalanine, valine, and leucine in AcOH and Pr^nCO_2H at 18° are recorded. W. McC.

Diffusion of hydrogen in iron. W. Baukloh (Metallwirts., 1938, **17**, 655—657).—The diffusion of H atoms through the Fe lattice is considered to be possible. Whilst grain boundaries and spaces in the lattice may play some part in the diffusion, it is unlikely that this is considerable, particularly in the case of grain boundaries. C. E. H.

Diffusion of hydrogen through nickel. C. B. Post and W. R. Ham (J. Chem. Physics, 1938, **6**, 598—605).—The diffusion of H_2 through commercial and very pure anode Ni has been studied from 1100° to 150°. The regular variation of the diffusion rates is broken at the Curie point, ~360°. The marked variation of the slopes of the isotherms from 0·5 near 360° was limited to within 3° of this temp. by prolonged heat-treatment of the Ni with H_2. The magnetic transition, as shown by diffusion, is abrupt. A sudden drop with rising temp. from 6600 to 5800 is observed at 360° for the work function in the purest Ni. No systematic breaks occur in the isobars at high temp. as found for Fe (cf. A., 1938, I, 76), but the diffusing H_2 possesses appreciable energy within the lattice. The Curie region, however, shows hysteresis similar to Fe (*loc. cit.*). Results obtained indicate that the Slater theory of the effect of temp. on ferromagnetism requires modification. The change from the ferromagnetic to the paramagnetic conditions in the transitional elements may be due to the displacement of an electron from the 3*d* shell to one of the 4-levels, followed by the dropping of another 4-level electron to the 3*d*-lovel. This process results in the pairing of electron spins in the 3*d* shell. W. R. A.

Diffusion of helium and of hydrogen through Pyrex chemically resistant glass. N. W. Taylor and W. Rast (J. Chem. Physics, 1938, **6**, 612—619).—The effects of temp. and of heat-treatment on Pyrex chemically resistant glass have been studied by measuring the rates of diffusion R of He (180—590°) and of H_2 (512°) through a tube of ~1 mm. wall thickness. $R \propto$ the gas pressure, and at temp. <548° increases ~10% by heat-treating the glass sufficiently to assure stabilisation. This fact indicates a chemical theory governing the diffusion process, rather than a simple theory of holes. For stabilised glass, and for the temp. range 440—590°, log R shows a continuous linear dependence on $1/T$; this temp. range extends into the region of a true viscous liquid, so that the properties of stabilised glass are continuous with those of a viscous liquid. Postulation of a separate glassy state is therefore superfluous, and the so-called " transformation point " is merely the temp. of rapid strain release of an unannealed sample. The small slope (for lower temp.) of the log R–$1/T$ curve near 440° is attributed to loss of rotational or vibrational freedom in the silicate complex. At 512°, R for He is 45 times that for H_2, due probably to the impedance of the progress of the H_2 mol. through the silicate network by chemical forces. W. R. A.

Diffusion of water, enriched with heavy hydrogen and heavy oxygen, through dilute gelatin gel. N. MORITA and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 543—555).—The rates of diffusion through 5% gelatin gel at 6°, measured by two different methods, are 1·12 and 1·83 sq. cm. per day. In each case heavy O diffuses as rapidly as D. E. S. H.

Distribution of minute amounts of material between liquid phases. D. C. GRAHAME and G. T. SEABORG (J. Amer. Chem. Soc., 1938, **60**, 2524—2528).—In the partition of $GaCl_3$, $MnCl_2$, and other metal halides between Et_2O and aq. HCl, and of $(NH_4)_2Co(SCN)_4$ between H_2O and amyl alcohol, at 20°, the distribution of minute amounts (10^{-12}—10^{-15} g.) of the sol. substance is the same as at ordinary small concns. For several metallic halides the distribution ratios can be determined by the use of radioactive substances. E. S. H.

Thermochemical study of the distribution of radium between crystals and solutions of barium iodate. A. POLESSITSKI and A. KARATAEVA (Acta Physicochim. U.R.S.S., 1938, **8**, 251—257).—The distribution of Ra between crystals and aq. solutions of $Ba(IO_3)_2$ at 0°, 25°, 78°, and 100° and between these phases in the presence of $Ca(NO_3)_2$ at 25° has been determined. At 0—25° the distribution is in agreement with Ratner's thermodynamical theory (A., 1934, 139), but at 78—100° some deviations were observed, which may possibly be due to non-attainment of equilibrium. The variation of the distribution coeff. with composition of the solution also agrees with Ratner's theory. The process may be regarded as a true thermodynamical distribution between two immiscible phases. A. J. M.

Adsorption on a uniform surface. J. B. ZELDOVITSCH (Acta Physicochim. U.R.S.S., 1938, **8**, 527—530).—A uniform surface is defined as one at which $\varphi(E)$ is the same for all surface elements, where $\varphi(E)dE$ is the probability that the heat of adsorption on a given element is between E and $E + dE$. This is valid even when thermal agitation and surface fluctuations are present. The adsorption process is discussed from the viewpoint of the various theories connecting the time of relaxation of the surface and the time of adsorption. W. R. A.

Sorption of polar and non-polar gases by zeolites. R. M. BARRER (Proc. Roy. Soc., 1938. **A., 167**, 392—420).—The sorption isotherms of He, A, H_2, and N_2 on five zeolites were determined. Chabasite and analcite having three-dimensional networks act as powerful absorbents, the former taking up as much A or H_2 as H_2O of crystallisation. The fibrous natrolite and scolecite and the platy heulandite show only slight surface sorption. The sorption heats are calc. and compared with those for graphite. Sorption isotherms for NH_3 were determined for the same five zeolites; a tendency to form ammoniates when dehydration appears causes changes in the lattice. The different types of gas uptake are discussed. Heats of sorption of NH_3 on analcite, chabasite, and natrolite are evaluated. G. D. P.

Theory of adsorption from solutions. R. SCHUCHOVITZKI (Acta Physicochim. U.R.S.S., 1938, **8**, 531—548).—A theory based on adsorption potentials has been developed. Qualitatively the predictions of the theory agree with experimental data; quant. applications yield disagreements which are tentatively explained. W. R. A.

Electrical factors in the adsorption of polar molecules at the surface of solutions. R. DUBOIS and E. E. TODD (J. Amer. Chem. Soc., 1938, **60**, 2355—2359).—The marked discrepancy generally observed between the adsorption of solutes at an air-solution interface, as measured by dynamic methods, and the adsorption calc. from surface tension data by means of the Gibbs equation does not appear to be due to the electrification of gas bubbles in contact with the solution. Attempts to alter the adsorption of *p*-toluidine by moving bubbles by ionisation of the gas were unsuccessful. A marked decrease in apparent adsorption after subjecting the gas to the spark discharge or silent discharge before entering the adsorption apparatus is traced to a chemical origin. E. S. H.

Adsorption of diazo-compounds on cadmium and magnesium hydroxides. VI. Adsorption of cadmium ions on solid surfaces. F. P. DWYER (J. Proc. Austral. Chem. Inst., 1938, **5**, 338—346; cf. A., 1938, I, 212, 415).—When $Cd^{\cdot\cdot}$ solutions have been contained in vessels of Pyrex or soda glass, SiO_2, Ni, Pt, or Pb sufficient Cd remains even after washing with H_2O to give a reaction with " Cadion 2B " (I). Since this behaviour is independent of the anion present, it is probable that $Cd^{\cdot\cdot}$ ions are adsorbed physically, except in the case of Pb vessels where basic Cd carbonate may be produced by interaction with the surface film of basic Pb carbonate. This adsorbed layer is removed very slowly by cold H_2O and more rapidly by hot H_2O. It is removed immediately by aq. KCN or aq. NH_3, so vessels to be used for containing Cd test solutions should be washed out with aq. KCN to remove any adsorbed Cd. (I) cannot be used for determining small amounts of Cd, since the reaction involved is the catalytic change from the blue to the red form of the reagent. J. W. S.

Adsorption of gelatin by precipitated hydroxides. J. G. KANE (J. Indian Inst. Sci., 1938, **21, A**, 237—244).—The adsorption of gelatin by charcoal, SiO_2 gel, and oxides and hydroxides of Al, Fe^{III}, and Ni has been studied. The Freundlich equation holds for C but not for SiO_2. The adsorptive powers of the hydroxides and oxides are in the order Al > Fe > Ni, and moist hydroxide > dry hydroxide > oxide. Moist $Al(OH)_3$ is completely peptised. With $Fe(OH)_3$ the adsorption increases as the wt. of hydroxide decreases, and this is interpreted in terms of dispersion of the ppt. by the gelatin solution. F. J. G.

Alteration of adsorption properties of charcoal; activation of charcoal in different gases at different temperatures. F. E. BARTELL and L. E. LLOYD (J. Amer. Chem. Soc., 1938, **60**, 2120—2125).—The preferential adsorption of C_6H_6–EtOH by C, activated at 1000°, 400°, and <150° in different oxidising atm., can be changed from organophilic to

hydrophilic type. The points of intersection of the S-shaped preferential adsorption curves with the composition axis are a measure of the relative organophilic or hydrophilic nature of the C. Aq. suspensions of C activated at 1000° contain positively and negatively charged particles and give acid adsorption; those activated at 400° are negatively charged and show base adsorption; those activated at <150° approach hydrophilic SiO_2 in adsorptive properties, contain negative particles, and show acid and base adsorption. E. S. H.

Migration of molecules from adsorption films on metals by consecutive layers. A. ACHMATOV (Acta Physicochim. U.R.S.S., 1938, **8**, 373—376).—Vals. of ΔV, the phase boundary potential difference between a layer of a polar org. substance in a volatile solvent and the vapour of the solvent, have been determined for layers on a clean optically plane Ag plate, the free Ag surface being sprinkled with C dust. For a unimol. layer, ΔV steadily decreases with time, becoming zero after ~1 hr., owing to slow migration of the solute mols. across the Ag surface; for multimol. layers, the curve ΔV against time has a periodic character, sometimes exhibiting max. and min. of ΔV, the no. of which is in strict agreement with the no. of unimol. layers present at the beginning of the experiment. This indicates that migration of mols. in an adsorption film proceeds by consecutive layers, an even no. of residual unimol. layers corresponding with a min. of potential, whilst an odd no. yields a max. W. R. A.

Lamellar structure of CaF_2 layers and the adsorption of cæsium and iodine. C. J. DIPPEL and J. H. DE BOER [with J. A. OTTEN] (Rec. trav. chim., 1938, **57**, 1087—1096).—The variation of the apparent thickness of CaF_2 lamellæ as measured by the adsorption of I may be attributed either to a variation of the mean thickness or to a sintering of the primary lamellæ. Comparison with the adsorption of Cs affords a decision between these possibilities, since the Cs atoms can penetrate between the sintered surfaces (cf. A., 1938, I, 245). The results indicate that the thickness of the primary lamellæ is almost const. and = 6 or 7 mols., that the degree of sintering increases as the speed of sublimation of the CaF_2 decreases, and that the max. thickness of the Cs layers is 3 atoms. F. J. G.

Flow and viscosity of unimolecular layers. M. JOLY (J. Phys. Radium, 1938, [vii], **9**, 345—351).—The validity of several theories which allow the calculation of the surface flow and true η is discussed. W. R. A.

Surface viscosity of long-chain alcohol monolayers. L. FOURT and W. D. HARKINS (J. Physical Chem., 1938, **42**, 897—910).—Methods based on the damping of oscillating rings, discs, and vanes by a surface monolayer give consistent vals. of surface viscosity (η_s). A method based on the torque required to maintain uniform rotation of a ring in the surface has also been developed. Measurements have been made on condensed films of the alcohols $C_{14}H_{29}$·OH to $C_{18}H_{37}$·OH. The low-pressure linear portions of the compression curves correspond with low vals. of η_s, which increase rapidly with increasing pressure and are the greater the longer is the C chain. The high-pressure linear section of the compression curve is associated with high apparent η_s, which is greater at low rates of shear and attains a max. as the collapse point of the film is approached. With $C_{18}H_{37}$·OH the η_s is non-Newtonian even below the kink-point of the compression curve. J. W. S.

Phase boundary forces at the gas–liquid interface. VI. Electrical properties of unimolecular films of ω-bromohexadecoic acid. M. GEROVITSCH and D. VARGIN (Acta Physicochim. U.R.S.S., 1938, **8**, 63—76).—Surface pressures and phase boundary potentials have been measured for films of $Br·[CH_2]_{15}·CO_2H$ on dil. buffer solutions at p_H 6·5—8·5. The true potential for stable films is −0·60 to −0·62 v. but traces of metallic salts (*e.g.*, 10^{-5}M-$CuSO_4$ or salts derived from the brass trough) may raise the potential to −0·87. The potential depends on salt concn. and cation valency. On solutions of p_H <7·0 the film becomes unstable owing to formation of aggregates and at p_H >8·5 it dissolves in the substrate. J. A. K.

Surface effects in the crystallisation of thin films of supercooled liquids. II. G. L. MICHNEVITSCH and I. E. BROVKO (Acta Physicochim. U.R.S.S., 1938, **8**, 103—112; cf. A., 1937, I, 562).—The distribution of crystallisation nuclei in films of supercooled betol was obtained by microscopic counting. Magnetic fields influence the orienting effects of the surface forces. J. A. K.

Electrical properties of multi-layers. R. W. GORANSON and W. A. ZISMAN (Physical Rev., 1938, [ii], **54**, 544).—Investigations on multi-layers of various stearates deposited on ebonite rods showed that *X*-type multi-layers were always positively charged and *Y*-type uncharged; the charge was ∝ layer area, increased regularly with the no. of layers deposited, and was a summation of charges distributed throughout the vol. The construction and properties of the multi-layers are described and discussed. N. M. B.

Photochemical reactions in monolayers. II. Photochemistry of proteins. J. S. MITCHELL and E. K. RIDEAL (Proc. Roy. Soc., 1938, **A**, **167**, 342—367).—The changes in phase boundary potential of monolayers of wheat gliadin, zein, insulin, and ovalbumin on irradiation by ultra-violet light, λ 2350—3175 A. are measured. Irradiation causes liquefaction of the monolayer and an increase of surface pressure, indicating the occurrence of fragmentation of the protein mol. It is suggested that under ultra-violet radiation the peptide linkages adjacent to each chromophoric side-chain undergo photolysis (cf. A., 1937, I, 370), and that the liberated chromophoric residue is removed by dissolution. The quantum efficiency of the total changes in monolayers of gliadin on 0·01N-H_2SO_4 is approx. 0·5. G. D. P.

Monolayers of denatured egg-albumin. H. S. BULL (J. Biol. Chem., 1938, **125**, 585—598).—Heat-denatured and urea-denatured egg-albumin may be spread on a 0·0066N-NaOAc buffer at p_H 4·9, if the protein is spread from solutions of p_H below 4·4. When fully spread, films of the denatured proteins have areas and compressibilities similar to those of

films of the native protein. The mols. of the two denatured proteins in aq. solution appear to be very asymmetrical. The adhesion tension for H_2O of the upper side of films of the native protein, deposited from films at various pressures on to glass slides, diminishes with increasing pressure. Heat-denatured egg-albumin may undergo surface coagulation by shaking the clear aq. solution. F. A. A.

Capillary ascent in cylindrical tubes. A. W. PORTER (Phil. Mag., 1938, [vii], **26**, 519—520).—A comparison of Rayleigh's (Proc. Roy. Soc., 1916, **92**, 184) four-term formula for β^2 and Poisson's three-term formula with Bashforth and Adams' results. Poisson's formula leads to vals. which are always too low while Rayleigh's gives figures which are too high if $\frac{1}{2}h_0/r <$ about 2. [A slight numerical error occurs in the calculations.] T. H. G.

Interfacial tension between mercury and water. D. C. HENRY and J. JACKSON (Nature, 1938, **142**, 616—617).—Vals. of 427 or 375 dynes per cm. can be obtained for the interfacial tension between Hg and H_2O according as O_2 is or is not rigidly excluded from the H_2O, and there are indications that the tension may have any val. between 375 and 427 dynes per cm. according to the O_2 pressure over the system. The effect of the dissolved O_2 appears to be the production of Hg ions which are strongly adsorbed at the interface. L. S. T.

Electrocapillary phenomena and the wetting of metals. III. Influence of surface-active substances on wetting. Properties of multimolecular layers. B. KABANOV and N. IVANISCHENKO (Acta Physicochim. U.R.S.S., 1937, **6**, 701—718; cf. A., 1937, I, 358).—In a system consisting of a gas (I) bubble simultaneously in contact with Hg (II) and aq. Na_2SO_4 (III) containing a surface-active substance, vals. of the interfacial tension, $\gamma_{I\text{-}II}$ have been calc. for different vals. of the potential, V, of Hg from the electro-capillary curves, $\gamma_{I\text{-}III}$, and the Hg–gas contact angle. The shape of the γ–V curves thus obtained is explained, assuming that the thickness of the electrolytic layer at the Hg–gas boundary increases with the surface charge. The variation of the adsorption of surface-active substances with charge of the Hg surface is described. A relation is derived relating the change of the contact area bubble–Hg, on changing the polarisation of the Hg, with the magnitude of the contact angle observed immediately after this change. This relation is used to calculate the approx. thickness of the electrolyte layer under the bubble. Thus, at a potential of −1·2 v. the layer begins to thicken, and becomes several hundreds of H_2O mols. thick at −1·7 v. W. R. A.

Viscosity of dilute solutions of long-chain molecules. I. M. L. HUGGINS (J. Physical Chem., 1938, **42**, 911—920).—By an extension of Kuhn's method (A., 1932, 993) an equation is derived relating the sp. viscosity (η_{sp}) of a solution with the dimensions and arrangement of the atoms in the solute mols. For mols. containing a large no. (n) of C atoms arranged in rod form it is deduced that $\eta_{sp}/c \propto n^2$, where c is the concn. of submols. (CH_2 groups etc.), and for randomly kinked chain mols. $\eta_{sp}/c \propto n$ (cf. A., 1935, 728). Assuming the effective radius of the CH_2 group to be $1{\cdot}54 \times 10^{-8}$ cm., theoretical vals. of η_{sp} are deduced which are in accord with experiment for dil. solutions of paraffins in CCl_4. J. W. S.

Heat contents of the salts of the alkali metals in extremely dilute aqueous solutions. T. F. YOUNG and P. SELIGMANN (J. Amer. Chem. Soc., 1938, **60**, 2379—2383).—Previous work on NaCl (A., 1936, 429) has been extended to all other salts of the alkali metals for which sufficient data are available for the application of the least-square technique. The average val. of the limiting derivatives S^0 for 11 salts of 1–1 valency at 25° and $S^0/3^{3/2}$ for 5 salts of 1–2 valency is about 30% > the average of former estimates based on an assumed linear relation between apparent mol. heat content and concn.$^{1/2}$. The new average agrees with the val. calc. from dielectric const. measurements and the Debye–Hückel limiting law. E. S. H.

Behaviour of aerosols prepared by spraying from solutions. G. JANDER and E. WYGASCH (Kolloid-Z., 1938, **85**, 1—8).—The production of aerosols of KI by spraying solutions of KI in MeOH or liquid SO_2 is described. Sols with a given mean particle wt. can be obtained by varying the concn. of the solution, but there is a great variation of particle weight in the same sol. The initial particle concn. can be controlled by varying the amount of solution sprayed. The stability and isodispersity of the sols increases with decreasing concn. of the solution. E. S. H.

Nature of foam. I. Stability of foam produced by aqueous solutions of alcohols and acids. T. SASAKI (Bull. Chem. Soc. Japan, 1938, **13**, 517—526).—The measurement of foam stability, S, by the height, H, of foam produced by an air current of const. velocity v is described. The relation $Sv = H - a$, where a is a const. (which is negligible under the conditions described), is deduced. Experimental data are given for foams produced by air in aq. EtOH, Bu$^{\alpha}$OH, n-amyl, -hexyl, -octyl, and -decyl alcohol, HCO_2H, and AcOH. For the pure liquids S is zero or very small. E. S. H.

Mechanical properties of foams. III. A. SIEHR (Kolloid-Z., 1938, **85**, 70—74; cf. A., 1937, I, 180).—Albumin foam behaves as a viscous liquid in passing through a tube, but as a gas on compression. A sp. property of "pressure accumulation" is shown when the foam passes through a narrow tube, due to high viscosity and compressibility. Means of avoiding this effect in dealing with foams are discussed. E. S. H.

Falling velocity of spherical particles [in gases].—See B., 1938, 1246.

Flow and settled states of dusts. O. BRANDT (Kolloid-Z., 1938, **85**, 24—32).—Experiments on the evacuation of settled dusts give no evidence of the existence of an adsorbed sheath of gas. Suspended, flowing, and settled dusts can be characterised by a flow factor k, which is determined by the wt. of dust which is borne by the gaseous dispersion medium. Thus, for settled dust $k = 0$, for suspended dust $k = 1$, and for flowing dust $k = <1$ and >0. The

effect of shaking settled dust is described in these terms. E. S. H.

Emulsions.—See B., 1938, 1245.

Water–oil emulsions. I. Preparation of anhydrous magnesium oleate.—See A., 1938, II, 428.

Dissolved state of highly polymerised substances. S. Papkov, S. Rogovin, and V. Kargin (Acta Physicochim. U.R.S.S., 1938, **8**, 647—658).—Several theories on the dissolved state of highly polymerised substances are considered, and it is shown that the solution represents mol. solution and not colloidal dispersion, the phase rule being completely applicable to the system, highly polymerised substance-solvent. W. R. A.

Macromolecular compounds. Determination of constitution. H. Staudinger (Chem.-Ztg., 1938, **62**, 749—754).—A review dealing with the constitution of colloidal particles, the proof of the macromol. structure of colloidal particles by converting them into compounds with the same degree of polymerisation, and the ageing of high-mol. substances. A. J. M.

Dynamic birefringence of colloids (Maxwell effect). Influence of dispersity. Experimental study of several polydisperse systems. C. Sadron and H. Mosimann (J. Phys. Radium, 1938, [vii], **9**, 381—383, 384—386; cf. A., 1938, I, 137).—I. Mathematical. The results previously obtained for monodisperse media apply also to a solution containing particles of different shape. General formulæ are derived which give the position of the neutral lines and the birefringence of a medium from the properties of its constituents. The position of the neutral lines, as a function of the speed of flow, can vary in a way different from that observed for monodisperse media. Some consequences of this are indicated.

II. Curves of dynamic birefringence have been obtained for some polydisperse media. Observed and calc. data are in qual. agreement. W. R. A.

Determination of sedimentation constant with ultracentrifuges without observation systems. M. Paić (Compt. rend., 1938, **207**, 629—632).—Relations are deduced which enable sedimentation consts. to be compared by measurement of the concns. of the sedimented substances in the solution before and after centrifuging. The relationships given are independent of the characteristics of the centrifuge. A. J. E. W.

Electrocrystallisation of metals. I. Electrolytic preparation of colloidal solutions of metals. G. S. Vozdvishenski (J. Appl. Chem. Russ., 1938, **11**, 770—775).—The colloidal solutions obtained by electrolysis of 0·0003N-$AgNO_3$ or -$HgNO_3$ (A., 1902, ii, 454) are of HgOH or AgOH, not of Hg or Ag, as claimed by Billitzer. R. T.

Nuclear gold sols. I. Determination of particle size. F. L. Usher (Trans. Faraday Soc., 1938, **34**, 1230—1233).—A rapid colorimetric method, having the same accuracy as the method used for calibrating the colour scale, is described. The colour of Au sols grown under proper conditions is, within the limits of accuracy of the experiments, strictly a function of particle size, and is independent of the reducing agent used when the latter is N_2H_4,H_2O, NH_2OH,HCl, or H_2O_2. F. L. U.

Formation of gold sols in alkaline solutions. L. L. Bircumshaw (Trans. Faraday Soc., 1938, **34**, 1236—1238).—Experiments on the influence of the ratio NaOH : $HAuCl_4$, temp., and time which elapses before reduction is effected show that, for the immediate production of a red sol by Zsigmondy's CH_2O method, all the Au must be present as aurate. F. L. U.

New aspect of colloidal gold reactions. H. M. Cassel (J. Physical Chem., 1938, **42**, 955—960).—The behaviour of hydrophilic sols towards Au sols is discussed with reference to the shape of the adsorption isotherms. J. W. S.

Effect of increasing doses of *X*-radiation on colloidal gold. J. A. Crowther (Nature, 1938, **142**, 569; cf. A., 1937, I, 461; 1938, I, 454).—Specimens of a Au sol exposed to doses of 4·9—5·5 r. were completely coagulated, whilst those of the same sol exposed to larger doses, 8·2—12·8 r., were not. Coagulation commenced again with a dose of 13·2 r. Ultramicroscopic examination showed that the doses producing coagulation are those which produce the greatest decrease in the electrokinetic potential of the particles. L. S. T.

Highly purified alumina sols. Z. Berestneva and V. Kargin (Acta Physicochim. U.R.S.S., 1938, **8**, 675—676).—Sols of Al_2O_3, prepared from $AlCl_3$ and aq. NH_3 and purified by dialysis, coagulate after the peptising agent is removed; the gels of Al_2O_3 thus obtained are again peptised on electrodialysis between Pt electrodes at potential gradients of from 100 to 200 v. per cm. Peptisation occurs after 60—70 hr. and a sol containing 1—2 g. of Al_2O_3 per l. is formed. The electrical conductivity (lowest val., $0·7 \times 10^{-6}$ ohm^{-1}) and cataphoretic velocity (v) have been measured. The computed ζ-potential is 44 mv. v for sols prepared in an atm. of H_2 has also been determined in an atm. of H_2. These latter sols are stable for several days and have conductivity $<1 \times 10^{-6}$ ohm^{-1}; they are not cataphoretically transferred for 30—40 min. The charges on particles of Al_2O_3 (and of SiO_2) sols are of secondary importance in stability and coagulation phenomena. W. R. A.

Thixotropic and plastic behaviour of suspensions of barium sulphate with clay. B. Tamamushi and Y. Sekiguchi (Bull. Chem. Soc. Japan, 1938, **13**, 556—565).—By adding Na-clay (formed by treating a natural H-clay with Na salts), non-thixotropic suspensions of $BaSO_4$ become thixotropic and their plasticity is increased. A correlation between thixotropy and sedimentation vol. is noted. E. S. H.

Viscosity of clay suspensions.—See B., 1938, 1297.

Gelation and film formation of colloidal clays. E. A. Hauser and D. S. Le Beau (J. Physical Chem., 1938, **42**, 961—969).—Theories of gel formation are discussed in connexion with ultra-micro-

scopic observations during gelation of very dil. clay sols. Gel formation is considered to occur when particles take up an equilibrium position with respect to one another. Self-supporting, coherent, and very flexible colloidal clay films can be produced in which all the particles are arranged along the same crystallographic axis. J. W. S.

X-Ray diffraction studies on heavy-metal ferrocyanide gels. H. B. WEISER, W. O. MILLIGAN, and J. B. BATES (J. Physical Chem., 1938, **42**, 945—954).—Ppts. of Cu, Zn, Cd, Co, Ni, Mn, and Ag ferrocyanides carry down considerable amounts of $K_4Fe(CN)_6$, but it is not possible to determine by conductometric or potentiometric titration whether the latter are adsorbed or if double salts are formed. X-Ray investigations indicate that $K_4Fe(CN)_6$ carried down by Cu, Co, Ni, and Mn ferrocyanides is not combined as double salt, but the X-ray patterns of the Zn, Cd, and Ag ferrocyanide ppts. differ according to whether excess of metal or of $Fe(CN)_6''''$ is used. This may be due to double salt formation. J. W. S.

Constitution of dilute soap solutions. II. Crystalline precipitates. P. EKWALL (Kolloid-Z., 1938, **85**, 16—24; cf. A., 1937, I, 78).—Solutions of Na laurate, myristate, palmitate, and stearate contain crystals of free fatty acid at high dilution, acid soap at intermediate concns., and neutral soap at higher concns. On warming the solutions, the fatty acid crystals melt when the m.p. is reached, the acid laurate, myristate, and palmitate become liquid-cryst., and the dil. acid stearate gives liquid crystals which, on further heating, decompose yielding isotropic drops of molten fatty acid. These reactions and transformations are reversible. A definite saturation concn. for neutral soap has been established. E. S. H.

Lyotrope series in swelling and its extension to organic and non-ionising substances. XIV. Effect of cations. XV. Effect of organic and inorganic acids on the swelling of starch. J. R. KATZ, J. SEIBERLICH, and A. WEIDINGER (Biochem. Z., 1938, **298**, 320—322, 323—325; cf. A., 1938, III, 842).—XIV. The effect of the chlorides of the alkali metals in lowering the swelling temp. (θ) of potato starch grains is $\ll$ that of alkaline-earth chlorides, the effectiveness of which increases with at. wt. θ is increased by alkali sulphates and still more by those of Al, Mg, and Be, but the effect of Na_2SO_4 is $>$ that of $BeSO_4$. The thiocyanates of all these metals greatly decrease θ.

XV. θ is reduced considerably by low concns. of HNO_3 and HBr, less by HCl and H_3PO_4, and is first slightly increased, then slightly decreased, by increasing $[H_2SO_4]$. AcOH decreases θ only slightly, but the effect increases as the H of the Me is replaced by Cl. The effects of citric and tartaric acid are almost the same as that of AcOH and the effect of AcSH is intermediate between those of $CH_2Cl{\cdot}CO_2H$ and $CHCl_2{\cdot}CO_2H$. W. McC.

Mol. wt. of cellulose and cellulose derivatives. E. O. KRAEMER (Ind. Eng. Chem., 1938, **30**, 1200—1203).—Comparison of the intrinsic viscosities $[\eta]$ and mol. wt. of celluloses in cuprammonium, cellulose acetate and nitrate in $COMe_2$, and ethylcellulose in dioxan, determined with the slow-speed Svedberg ultracentrifuge, supports Staudinger's conclusions that an approx. linear relation exists between the two. A review of the noted effect of solvent on $[\eta]$ and on osmotic pressure, together with measurements of the mol. wt. and $[\eta]$ of the intermediates obtained in the cyclic conversion of cellulose into its acetate and back, tends to show that the unit in dil. solution is the single mol. F. N. W.

Solubility of cellulose and its esters. IV. Solubility of cellulose acetate of high acetyl number. S. PAPKOV and K. KORSCHUNOVA (J. Appl. Chem. Russ., 1938, **11**, 859—866).—The crit. temp. of miscibility of cellulose acetate (I) in the binary mixtures EtOAc–EtOH, $CHCl_3$–EtOH, –PrOH, and –BuOH, and $PhNO_2$–EtOH is min. for mixtures containing ~25% of alcohol. In the ternary mixtures $COMe_2$–EtOH–$C_2H_4Cl_2$ and –dioxan the field of solubility of (I) diminishes as the degree of esterification rises. R. T.

Solution of cellulose xanthate.—See A., 1938, II, 433.

Viscosity of cellulose in phosphoric acid solutions. A. J. STAMM and W. E. COHEN (J. Physical Chem., 1938, **42**, 921—933).—When cellulose is swollen in H_2O and H_3PO_4 is added gradually, a clear solution is obtained, the viscosity of which has been studied as a function of concn., time, and applied pressure. At low rates of shear, mol. interference occurs with concns. $>2 \times 10^{-5}$ g. per c.c. With high rates of shear higher concns. can be used in the mol. wt. determinations. The mol. wt. of cellulose pulp, unbeaten or highly beaten, as determined by this method is 100,000, and that of cotton linters α-cellulose (I) is 113,000. The hydrolysis consts. of cellulose in H_3PO_4 calc. from viscosity data become const. after 4 hr. and are $7{\cdot}05 \times 10^{-6}$ and $5{\cdot}68 \times 10^{-6}$, for the pulp and for (I), respectively. J. W. S.

Dielectric properties of cellulose acetate.—See B., 1938, 1318.

Cellulose, hemicelluloses, and lignin.—See B., 1938, 1276.

Theory of the isoelectric point of proteins. A. PASSINSKI (Acta Physicochim. U.R.S.S., 1938, **8**, 357—370, and J. Phys. Chem. Russ., 1938, **11**, 451—460).—General formulæ are derived for the calculation of the isoelectric points of polypeptides and proteins from their ionisation consts. Calc. vals. for serum-albumin, three grades of gelatin, and edestin are in fair agreement with recorded experimental vals. The formulæ are applied to two complex polypeptides. W. R. A.

Variations in electric charge of proteins submitted to the action of proteolytic enzymes. II. Pepsin. I, II. J. LOISELEUR (Ann. Ferm., 1938, **4**, 129—140; cf. A., 1938, I, 398). I. A. P.

Solvation in disperse systems. I. Solvation of rubber in dispersion media of different polarities. II. Thermo-mechanical properties of rubber sols. V. MARGARITOV. III. Light-scattering by rubber sols in media of different

polarities. V. MARGARITOV and B. KOVARSKAJA (Acta Physicochim. U.R.S.S., 1937, **7**, 707—726; 1938, **8**, 271—278, 279—289).—I. Two types of solvents for rubber are distinguished, (i) hydrocarbons with a strong aptitude for surface solvation, the primary adsorbed layer protecting the micelle from osmotic swelling, and (ii) solvents characterised by small mol. dimensions, which penetrate into the micelles and cause osmotic swelling.

II. Rubber sols have been investigated (*a*) to study the effect of the mol. nature of the solvent on their mechanical properties, and (*b*) to determine the variation of the yield val. on cooling in different solvents under such conditions that the solvent does not freeze. The results indicate that the high mechanical strength of rubber sols in solvents (ii) is due to vol. solvation, developed by the swelling of micelles which become the centres of a gel which sets at a temp. > the f.p. of the pure solvent; rubber sols in solvents (i), with advanced surface solvation, form no gels on cooling.

III. The variation of the intensity of scattered light with the concn. of rubber sols and sols of Na divinyl polymeride has been studied in various solvents. The abs. turbidity X_1 of the rubber sols decreases as the solvent passes up the series of hydrocarbons. The variation of $1/X_1$ with dilution is linear. W. R. A.

Viscosity and dielectric dispersion of methacrylate resins in benzene solutions. G. W. GROSS, H. C. OTT, and O. M. ARNOLD (Trans. Electrochem. Soc., 1938, **74**, Preprint 31, 469—486).—The ρ, η, and change in ϵ over a frequency range of 1—10,000 kc. have been measured for C_6H_6 solutions of Me, Et, Pr^{α}, Bu^{α}, and Bu^{β} methacrylate polymerides. K. W. P.

Colloidal structure of rubber in solution.—See B., 1938, 1336.

Complex coacervation. J. SCHOOFS (Rev. Univ. Mines, 1937, **13**, 219—227).—The phenomenon of coacervation is reviewed. A theory is propounded and used to explain the properties, *e.g.*, η, of coacervates. Experiments showed that the η of a mixture of two oppositely charged sols is < that calc. by assuming additivity. R. B. C.

Electrolyte coagulation of weakly solvated sols and electrolyte activity. XI. Influence of ion spreading. W. OSTWALD (Kolloid-Z., 1938, **85**, 34—48).—By ion spreading is understood the quant. difference in the coagulating powers (for weakly solvated sols) of different ions of the same valency. On the basis of published data for 9 sols and 3 suspensions it is shown that the ion spreading can be described by the relation $f_k = 1 - b(r \pm a)$, where f_k is the individual activity coeff. of the dominating ion at the coagulation molarity m_k, r the ionic radius or a proportional val., and a and b are consts., which are related by $a + c = db$, The consts. d and c are of general validity for negative sols and are independent of valency of the ions and of the degree of ion spreading. A general ion-spreading equation of the form $f_k = 1 - (z + 2)b_1/3(r + za_1)$ is derived, where z is the valency of the dominating ion, and a_1 and b_1 are the consts. for univalent ions. This equation permits ionic radii to be calc. from coagulation measurements. E. S. H.

Displacement of the absorption limit during flocculation of manganese dioxide sols with mercurous sulphate solution. A. PURUSHOTHAM (Kolloid-Z., 1938, **85**, 33—33).—During coagulation the absorption limit at about 7800 A. is unchanged, but that at 4700 A. is displaced progressively to about 4500 A. E. S. H.

Wave nature of the periodic reaction of silver dichromate. V. K. NIKIFOROV and S. S. CHARAMONENKO (Acta Physicochim. U.R.S.S., 1938, **8**, 95—102).—It is shown experimentally that Liesegang's rings exhibit the properties of waves. Huyghens' principle holds for diffusion through a hole. Measurements of "velocity" and "refraction" of the rings on passing into another medium (*e.g.*, gels of different concn.) agree with Snell's law. The relation $_1n_2 = 1/_2n_1$ is confirmed by experiments with the rings diffusing in opposite directions. The phenomena are attributed to de Broglie waves. J. A. K.

Rhythmic precipitation of lead iodate in gelatin. Interfacial interpretation of chemical periodicities of structure. (MLLE.) S. VEIL (Bull. Soc. chim., 1938, [v], **5**, 1393—1394).—Liesegang rings of amorphous $Pb(IO_3)_2$ are formed on pptn. in gelatin, the cryst. form not being rhythmically pptd. The effect of interfacial tensions on rhythmic pptn. phenomena is discussed. A. J. E. W.

Surface phenomena with charged spherical particles moving in a solvent. Cataphoresis. Sedimentation potential. J. J. HERMANS (Phil. Mag., 1938, [vii], **26**, 650—674).—The deformation of the double layer around a spherical particle moving in an electrolyte solution under the influence, or in the absence, of an external electric field, is calc. for the case where the thickness of the double layer is $\ll$ the radius of the particle. The formula obtained for cataphoretic velocity (v) shows that (1) max. may occur in v with increasing ζ-potential; (2) the charge calc. from v will not generally tally with that determined directly; (3) v will be approx. the same as the electro-osmotic velocity only in special cases. A formula for sedimentation potential is derived, from which it is calc. that vals. of about 10 mv. may occur when large particles fall in distilled H_2O under gravity. F. L. U.

Charged colloid particles in an ultrasonic field. II. Particles surrounded by a thin double layer. J. J. HERMANS (Phil. Mag., 1938, [vii], **26**, 674—683; cf. A., 1938, I, 247).—Approx. calculations of the p.d. between a node and antinode, due to deformation of the double layers of particles suspended in a liquid through which a plane sonic wave is moving, are made for a favourable case. The formulæ derived indicate that the p.d. may reach several v. F. L. U.

Equilibrium in electrodeless discharge. V. Equilibrium in the dissociation of oxygen and in the formation of ozone in silent electric discharge. R. KRISHNAN and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, **A**, 223—236).—The changes

of pressure, p, during the action of the silent discharge on O_2 have been followed. For high initial p there is a gradual fall to an equilibrium val., but for low initial p there is at first a rise and then a fall. The results are interpreted in terms of the two equilibria $O_2^* \rightleftharpoons 2O$ and $O_2^* + O \rightleftharpoons O_3$, and from the measurements equilibrium consts. are calc. for these. F. J. G.

Ethane equilibrium. R. N. PEASE and A. M. BYERS, jun. (J. Amer. Chem. Soc., 1938, **60**, 2489—2491).—The equilibrium $C_2H_4 + H_2 \rightleftharpoons C_2H_6$ has been re-investigated to determine whether the occurrence of side reactions and the production of propylene could have invalidated previous analytical work (cf. A., 1937, I, 466). The evidence is that the error is $<10\%$. E. S. H.

Kinetic method of determining the equilibrium constants in the synthesis of methyl alcohol. G. NATTA and G. PASTONESI (Chim. e l'Ind., 1938, **20**, 587—591).—A general method of determining the equilibrium const. of a reversible process from calc. vals. of the velocity coeff. for the forward and reverse reactions is described. The method is illustrated from data for the process $CO + 2H_2 \rightleftharpoons MeOH$. For calculating the two velocity coeffs. kinetic data for the forward process only need be used. The results suggest that the synthesis is bimol. O. J. W.

Exchange of deuterium between methyl alcohol and water. Vibrations of the hydroxyl group in methyl alcohol and methyl deuteralcohol. Entropy of methyl alcohol. J. O. HALFORD and B. PECHERER (J. Chem. Physics, 1938, **6**, 571—575).—The exchange equilibrium between MeOH and D_2O has been measured at 80°. The equilibrium consts., calc. from masses, moments of inertia, and fundamental ν by statistical methods and obtained experimentally, are discussed in relation to the OH vibrations and the torsional degree of freedom. The entropy of MeOH from thermodynamic data differs from the val. deduced from the spectral data by an amount which is contributed by the torsional motion. W. R. A.

Displacement of equilibrium by substances which simultaneously act as catalytic accelerators. IV. N. SCHLESINGER and M. KIREEV (Acta Physicochim. U.R.S.S., 1937, **6**, 769—780).—An extension of previous work (cf. A., 1936, 1462) to the reaction $EtOH + Pr^nCO_2H \rightleftharpoons Pr^nCO_2Et + H_2O$. W. R. A.

Relation between equilibrium constants in water and in other solvents. I. M. KOLTHOFF, J. J. LINGANE, and W. D. LARSON (J. Amer. Chem. Soc., 1938, **60**, 2512—2515).—The product and quotient of the distribution coeffs. of ions between two solvents can be determined, and permit the equilibrium consts. in one solvent to be calc. from the known vals. in H_2O. The ionisation consts. of 6 acids in MeOH and EtOH have been calc. from distribution data and the vals. of the consts. in H_2O. The calc. vals. agree fairly with experimental determinations. E. S. H.

Pyknometric studies on chemical equilibrium. C. DRUCKER (Trans. Faraday Soc., 1938, **34**, 1214—1218).—Expressions are derived to show the relation between changes in the sp. vol. of a solution of two substances in equilibrium with concn. and the equilibrium const. The formulæ are applied to measurements of the d of $HgCl_2$, $Hg(CN)_2$, $COMe_2$, and acetoxime in H_2O, and of $CCl_3{\cdot}CO_2H$, $CBr_3{\cdot}CO_2H$, and phenanthrene picrate and its components in xylene. Where comparison is possible the calc. vals. of K agree with those determined by other methods. F. L. U.

Complex formation between carboxylic acids and bivalent metal cations. R. K. CANNAN and A. KIBRICK (J. Amer. Chem. Soc., 1938, **60**, 2314—2320).—H-electrode titration curves of several mono- and di-carboxylic acids in KCl–MCl_2 mixtures (where M = Mg, Ca, Sr, Ba, or Zn) of const. ionic strength have been determined. The results obtained can be explained in terms of mass action consts. for the formation of binary compounds between the cations and the carboxylate anions. E. S. H.

Interaction between solutes and polar solvents. I. Electrolytes. II. Polar molecules. W. J. DUNNING and W. J. SHUTT (Trans. Faraday Soc., 1938, **34**, 1192—1199, 1199—1202; cf. A., 1938, I, 245).—I. The solubilities of $PbCl_2$ and of AgCl in H_2O, aq. glycine, and aq. $CO(NH_2)_2$, determined at 25°, are in qual. agreement with Born's equation relating solubility with the dielectric const. of the solvent. The vals. calc. for the mean ionic radii are < those derived by other methods. The ion–solvent interaction is predominantly electrostatic in character.

II. The solubility of glycine in aq. $CO(NH_2)_2$ decreases with increasing $[CO(NH_2)_2]$ when expressed as mols. per l., but when referred to 1000 g. of H_2O is almost const. in the concn. range 0—5M-$CO(NH_2)_2$. It is considered that the shorter range of the electrostatic forces around zwitterions accounts for the difference between the solubility relations of the latter and those of simple ions. F. L. U.

Symmetries of the fields about ions in solution. Equilibrium between forms of different symmetry. S. FREED and H. F. JACOBSON (J. Chem. Physics, 1938, **6**, 654—655; cf. following abstract).—The absorption spectra of $Eu(NO_3)_3$ and of $EuCl_3$ in aq. solutions have been examined in the blue region. The nitrate exhibits 3, and the chloride 4, lines of different spacing, sharpness, and relative intensity. Dilution from 1·5M to about 0·01M produces no change in the patterns, but although at 0·0007M the pattern of the chloride remains unchanged, that of the nitrate changes from 3 lines to 4, indistinguishable from those of the chloride. At concns. 0·01—0·0007M the nitrate shows both spectra, the chloride pattern gaining intensity at the expense of the nitrate pattern with increased dilution. These data indicate that in aq. solution the nitrate distributes itself between two discrete configurations in equilibrium corresponding with different symmetries of the fields about the $Eu^{\cdots}$ ion. W. R. A.

Symmetries of the fields about ions in solution and electrolytic dissociation. S. FREED (J. Chem. Physics, 1938, **6**, 655—656; cf. preceding abstract).—The absorption spectrum of a crystal of hydrated $Eu(NO_3)_3$ contains 3 lines in the blue

group with roughly the same intervals as are observed for the solution of the nitrate. Thus the fields around the $Eu^{\cdots}$ ions in the crystals and in solution are almost identical, and hence the salts of Eu have permanently oriented bonds. These salts are, however, strong electrolytes. The rather permanent, discrete geometrical configurations which the spectra indicate for the fields about the $Eu^{\cdots}$ ions are those considered characteristic of non-electrolytes. This behaviour is not due to some singular electronic distribution of Eu. The spectra further give no indication that the discrete structures will disappear at greater dilution. W. R. A.

Dissociation constants of 2 : 4-diketo-5 : 5-dialkyl-oxazolidines and -thiazolidines.—See A., 1938, II, 462.

Calculation of the ionisation constants of inorganic oxygen acids from their structures. A. KOSSIAKOFF and D. HARKER (J. Amer. Chem. Soc., 1938, **60**, 2047—2055).—Theoretical. The method of evaluation depends on the resolution of the free energy of ionisation into one part which is essentially const. for all non-resonating oxygen acids in a given solvent, and another part which depends on the structure of the acid. The const. part constitutes a parameter in the equation; the variable part can be explicitly calc. from structural data. After determination of the parameter from the experimental ionisation const. of a single acid of known structure, the ionisation consts. of a large no. of acids have been evaluated with an average accuracy of $\pm 0{\cdot}8$ in log K. The structures of several acids have been determined from their known strengths. The effect of resonance on the strength of acids is discussed. E. S. H.

Ionisation constants of acid–base indicators in methyl alcohol. I. M. KOLTHOFF and L. S. GUSS (J. Amer. Chem. Soc., 1938, **60**, 2516—2522; cf. A., 1938, I, 197).—Thermodynamic ionisation consts. of bromophenol-blue, bromocresol-green and -purple, bromothymol-blue, phenol-red, thymol-blue, Me-orange, Me-red, Me-yellow, neutral-red, thymolbenzein, and several acids have been determined and the effects of ionic strength studied. The behaviour of the indicators is in general agreement with current concepts. The behaviour of Me-red is best explained on the basis of the existence of the free NH_2-acid form, and not of the hybrid form, although this interpretation does not entirely account for the salt effect. At very small ionic strengths the salt effect can be accounted for quantitatively by the limiting Debye–Hückel expression. E. S. H.

Physical chemistry of cystinyl peptides. J. P. GREENSTEIN, F. W. KLEMPERER, and J. WYMAN, jun. (J. Biol. Chem., 1938, **125**, 515—526).—The four acidity consts., in aq. solution at 38°, of cystinyldiglycine are 3·21, 3·21, 6·36, and 6·95, and of cystinyldidiglycine are 3·29, 3·29, 6·01, and 6·87. The dielectric increments of these and other dipeptides of the structure R·S·S·R, where R is a peptide residue containing $-NH_3^+$ and $-CO_2^-$ groups, agree well with vals. calc. on the assumption that there is free rotation around the S–S linkage. This free rotation in peptides is discussed in relation to anomalous dispersion at radio frequencies found with proteins. F. A. A.

Electrometric and polarimetric study of [aqueous] mixtures of hydrofluoric acid with hydrochloric and perchloric acids. (MLLE.) F. PERRIER (J. Phys. Radium, 1938, [vii], **9**, 352—354).—HF in presence of other acids attacks glass more rapidly than HF alone. To test whether this was due to increased acidity, (i) the $[H^+]$ in HF, HCl, $HClO_4$, and mixtures of HF with HCl, and with $HClO_4$, have been measured electrometrically, and (ii) the velocities of mutarotation of glucose in the presence of the same acids and acid mixtures have been determined. The acidities of the mixtures are $>$ the sum of the acidities of the two solutions. W. R. A.

Activity of nitrobenzene in binary systems with aliphatic halogen compounds. K. HRYNAKOWSKI and M. SZMYT (Z. physikal. Chem., 1938, **182**, 405—412; cf. A., 1938, I, 459).—Eutectic data recorded are: with CH_2Cl_2, 9% $PhNO_2$, m.p. −97·2°; with $CHCl_3$, 18·5% $PhNO_2$, m.p. −71·0°; with CCl_4, 15·5% $PhNO_2$, m.p. −34·5°. No definite compounds are formed. The theoretical crystallisation curves and activity coeffs. (f) for $PhNO_2$ have been calc. In all cases f is >1; in the system $PhNO_2$–CH_2Cl_2 it increases considerably, and in the system $PhNO_2$–CCl_4 it increases slightly, with decrease of $[PhNO_2]$. Indefinite association complexes are formed with CCl_4. J. W. S.

Interpretation of diffusion data for strong electrolytes. P. VAN RYSSELBERGHE (J. Amer. Chem. Soc., 1938, **60**, 2326—2331).—Diffusion mobilities of KCl, NaCl, and KNO_3 in H_2O have been calc. from recorded diffusion coeffs. and thermodynamic factors, and compared with theoretical vals. obtained by means of the Onsager–Fuoss theory of diffusion, by applying the simple viscosity correction to the mobility at infinite dilution, and by applying the viscosity correction to the Onsager–Fuoss mobilities. The viscosity correction is at least as important as the Onsager–Fuoss interionic effects; with NaCl the correct sign for the variation of the mobility cannot be obtained without the viscosity correction. The min. in the diffusion and activity coeff. curves are discussed, and a modified form of the Stokes–Einstein law of diffusion is proposed. E. S. H.

Thermodynamics of hydrochloric acid in dioxan–water mixtures from electromotive force measurements. V. Properties of 45% dioxan mixtures. H. S. HARNED and J. G. DONELSON. **VI. Extrapolations in 70% dioxan mixtures and standard potentials.** H. S. HARNED and C. CALMON. **VII. Properties of 70% dioxan mixtures.** H. S. HARNED, J. G. DONELSON, and C. CALMON (J. Amer. Chem. Soc., 1938, **60**, 2128—2130, 2130—2133, 2133—2135; cf. A., 1938, I, 196).—V. E.m.f. of the cells H_2|HCl (M), 45% dioxan–H_2O|AgCl–Ag have been measured at 5° intervals from 0° to 50° and with 0·1—3M-HCl. From these and published data the activity coeff., relative partial mol. heat content, and heat capacity of HCl have been calc. for the above ranges of temp. and concn.

VI. The standard potential of the cell H_2|HCl (M), 70% dioxan–H_2O|AgCl–Ag, calc. from e.m.f. measurements at 0—50° and with 0·0008—0·003M-HCl with the further aid of published data, is given by $0·06395 - 17·67 \times 10^{-4}(\theta - 25) - 3·70 \times 10^{-6}(\theta - 25)^2$.

VII. E.m.f. measurements of the cell H_2|HCl (M), 70% dioxan–H_2O|AgCl–Ag at 0—50° have been extended to the concn. range 0·1—1·5M-HCl. The activity coeff., relative partial mol. heat content, and heat capacity of HCl for these ranges have been calc. Sources of error in the results are discussed. E. S. H.

Shapes of molecules and cohesion forces. II. Anomalous behaviour of long thread-like molecules in solution. G. BERGER (Rec. trav. chim., 1938, **57**, 1029—1049).—The ebullioscopic behaviour of a no. of *n*-paraffins ranging from C_{10} to C_{32} and also of *n*-Δ^9-$C_{16}H_{32}$, $CO(C_{13}H_{27})_2$ and $CO(C_{15}H_{31})_2$, $C_{10}H_8$ and $C_{10}H_{18}$, in C_6H_6, C_6H_{14}, and *cyclo*hexane has been studied. Raoult's law holds as a limiting law at infinite dilution, but at finite concn. departures are found, the lower hydrocarbons showing an apparent association which decreases with increasing mol. wt. until the higher members are apparently dissociated. Further, a particular solute behaves differently in the three solvents and may be apparently associated in C_6H_6 and dissociated in *cyclo*hexane. The abnormalities are not accounted for by current theories, but can be interpreted in terms of London forces between "contact positions" (H atoms) when account is taken of the shapes of the solvent and solute mols. F. J. G.

Cryoscopy in solutions of salts. E. CORNEC and H. MULLER (Compt. rend., 1938, **207**, 578—580).—The mol. f.p. depression consts. (K) for a no. of salts at different concns. (c) in aq. KNO_3 have been determined. The K/c curves approach linearity with moderate concns. of KNO_3, but unless the eutectic proportion of KNO_3 is used the extrapolated vals. of K for $c = 0$ are not simply related; the use of the KNO_3–H_2O eutectic (A., 1932, 691) is explained. A. J. E. W.

Complete phase diagrams with respect to pressure, temperature, and composition of binary systems with vapour pressure maxima in the liquid mixtures. II. E. JÄNECKE (Z. physikal. Chem., 1938, **182**, 413—420; cf. A., 1938, I, 450).—Theoretical. J. W. S.

Equilibrium diagrams of helium–nitrogen mixtures. A. FEDORITENKO and M. RUHEMANN (Tech. Phys. U.S.S.R., 1937, **4**, 36—43).—The p–x diagrams of He–N_2 mixtures have been determined at 64°, 78°, 90°, and 108° K. between 5 and 150 atm. The [He] in the gaseous phase increases as the temp. is lowered and the liquid branch of the diagram becomes steeper. T–x diagrams were obtained at 4 and 20 atm. and from these i–x or Merkel diagrams were computed. F. J. L.

Equilibria in two-phase gas–liquid hydrocarbon systems. II. Methane and pentane. E. H. BOOMER, C. A. JOHNSON, and A. G. A. PIERCEY. **III. Methane and hexane.** E. H. BOOMER and C. A. JOHNSON (Canad. J. Res., 1938, **16**, B, 319—327, 328—335; cf. A., 1937, I, 636).—II. The p and composition of both phases in the *n*-C_5H_{12}–CH_4 solubility equilibrium have been determined at 25°, 55°, and 85° at total pressures from 35 to 190 atm., the crit. pressures of complete miscibility being respectively 175, 171, and 162 atm. The properties of the system are discussed. Similar measurements at 25° and at pressures from 35 to 135 atm. have been made for a mixture of *n*- and *iso*-C_5H_{12} and CH_4, the solubility of CH_4 in the mixture being > in *n*-C_5H_{12} alone. The effect of isomerisation of the solvent on the equilibrium const. of the solute is appreciable.

III. Similar measurements have been made for a mixture of *n*-C_6H_{14} and CH_4 at 25°, 55°, and 85° at total pressures from 35 to 230 atm., the crit. pressures of complete miscibility being respectively 214, 210·5, and 201 atm. At the lowest pressure used CH_4 was more sol. (in mol.-%) in C_6H_{14} than in C_5H_{12} but less sol. at all other pressures. The behaviour of the C_5H_{12}–CH_4 and C_6H_{14}–CH_4 mixtures is essentially similar. The solubility of CH_4 in a mixture of isomeric C_6H_{14} is > in *n*-C_6H_{14}, the crit. pressure for complete miscibility at 25° being 203·5 atm. F. H.

Formation of surfaces in liquid–liquid separation. V. V. LEPESCHKIN (Kolloid-Z., 1938, **85**, 52—56).—The conditions under which two liquid phases are formed in the system EtOH–H_2O–$(NH_4)_2SO_4$ at 20° have been determined. The separation process is considered to consist in the salting-out of EtOH. Published work on the liquid–liquid separation of hydrophilic sols is discussed. E. S. H.

Mercuric halide dioxanates. J. L. CRENSHAW, A. C. COPE, N. FINKELSTEIN, and R. ROGAN (J. Amer. Chem. Soc., 1938, **60**, 2308—2311).—V.p. of dioxan and of saturated solutions of dioxanates in dioxan, and dissociation pressures of the dioxanates have been determined. The compositions of the dioxanates correspond with the combination of 1 mol. of halide with 1 mol. of dioxan. Transition points in the solid state are observed at 87·7° for $HgBr_2,C_4H_8O_2$, and at 173·1° for $HgI_2,C_4H_8O_2$. Free energies and heats of formation of the dioxanates have been calc. E. S. H.

Binary systems of phenylethylbarbituric acid with camphor, chloretone, and trional. A. MOSSINI (Boll. Chim. farm., 1938, **77**, 573—574).—Data for the temp. at which crystals first separate from the melt and at which solidification is complete are tabulated for the above systems. No compounds appear to be formed. F. O. H.

Ternary systems sodium iodate–sodium chlorate–water and potassium iodate–potassium chlorate–water at 25° and 50°. J. E. RICCI (J. Amer. Chem. Soc., 1938, **60**, 2040—2043).—Solubility data are recorded. No evidence of the formation of compounds or solid solutions was obtained. E. S. H.

Supersaturated solutions in the system $MgSO_4$–Na_2SO_4–H_2O at 25°. E. J. LEVINA (J. Appl. Chem. Russ., 1938, **11**, 759—769).—Stable and metastable equilibrium data are recorded. R. T.

Phase study of the system sodium palmitate–sodium chloride–water at 90°. R. D. Vold and R. H. Ferguson (J. Amer. Chem. Soc., 1938, **60**, 2066—2076).—An isopiestic v.p. method for the study of soap systems at high temp. and concn., where other methods are inapplicable owing to non-separation of phases, is described. The method has been applied to the determination of the equilibrium diagram of the above system. The results show (1) that the curd phase can exist in true reversible equilibrium with neat soap, and that the two are separate phases; (2) that no stoicheiometric hydrates occur in the system at 90°, the [H_2O] of the curd phase varying continuously. The formation and appearance of curd fibres are described.

E. S. H.

Phase equilibria studies on mixtures of the compounds $4CaO,Al_2O_3,Fe_2O_3$, $2CaO,Fe_2O_3$, and K_2O,Al_2O_3. W. C. Taylor (J. Res. Nat. Bur. Stand., 1938, **21**, 315—325).—Portions of the system CaO–Al_2O_3–Fe_2O_3–K_2O have been studied by the quenching method. No ternary compounds containing K_2O have been detected. K_2O,Al_2O_3 and $4CaO,Al_2O_3,Fe_2O_3$ (I) form a binary system with one eutectic. For a given ratio of (I) to $2CaO,Fe_2O_3$, the solid solution of these two compounds forms a pseudo-binary system with K_2O,Al_2O_3. Temp.–concn. diagrams for sections of the quaternary system are given.

J. W. S.

Heats of formation and combustion. R. Lautié (Bull. Soc. chim., 1938, [v], **5**, 1306—1321).—The linear relationships occurring in Carlsohn groups between the abs. b.p. and T_c, $[P]$, the at. or mol. vols. at T_c and at the b.p., and the abs. m.p. are discussed. In a homologous series, T_c is a linear function of $[P]^{\frac{1}{3}}$. In some groups (*e.g.*, org. and inorg. halides, oxides, sulphides, selenides, tellurides, carbonates, nitrates, and carbonates), linear relations occur between the heats of formation, dilution, and combustion of corresponding members of pairs of Carlsohn series. These properties are not additive. Accurate linear functions giving heats of combustion in a no. of homologous series in terms of the no. of C atoms are given. The effect of cyclisation on $[P]$ and the heat of combustion is considered. (Cf. A., 1938, I, 603.)

A. J. E. W.

Heat of formation and specific heat of chromium nitride. S. Satoh (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1001—1009).—The mean sp. heats of Cr_2N and CrN were measured by the ice calorimeter over the temp. intervals 0—99·5°, 0—325·7°, and 0—511°, and the equations for the true sp. heats for these intervals were obtained. Using these vals., the heats of formation computed from the dissociation pressures at high temp. are: Cr_2N 26,340, CrN 28,260 g.-cal.

N. M. B.

Molecular heat of combustion of glyoximes. M. Milone and G. Venturello (Atti R. Accad. Sci. Torino, Cl. Sci. fis., 1936, **71**, I, 395—401; Chem. Zentr., 1937, i, 571. Cf. A., 1935, 810).—Examination of glyoxime and its Me, Me_2, Ph, *p*-tolyl, and Ph_2 derivatives shows that the last-named exists in three geometric forms, whilst the isomerides of phenyl- and *p*-tolyl-glyoxime are structurally distinct. The difference between the calc. (12·6 and 11·7 v. for C:N·OH and CH:NO respectively) and observed (13·5 v.) energy vals. is ascribed to resonance, especially as cyclic configurations of αβ-dioximes must also be considered.

A. H. C.

Heat of reaction of wool with acids. J. B. Speakman and E. Stott (Trans. Faraday Soc., 1938, **34**, 1203—1209).—At low p_H vals. the heat of reaction ($-\Delta U$) per g.-equiv. of wool is greater in $CH_2Cl{\cdot}CO_2H$ than in HCl. This result is attributed to the liberation of ·NH· associated with the greater swelling produced by $CH_2Cl{\cdot}CO_2H$, a view supported by the observation that with this acid $-\Delta U$ per mol. of combined acid decreases with fall of p_H below 2·0, whilst with HCl it is independent of p_H below 2·0. The low val., 3·56 kg.-cal., indicates that the basic side-chains of wool are in combination as salt linkages.

F. L. U.

Electrical conductivity of solutions at different frequencies. VIII. Oscillograph tests on conductivity cells. S. F. Acree, E. Bennett, G. H. Gray, and H. Goldberg (J. Physical Chem., 1938, **42**, 871—896).—Both the steady-state and transient relations between the a.c. through a conductivity cell and the p.d. across its terminals are the same as those for an appropriate condenser with a resistance in series, so long as the e.m.f. applied is $\ll$ the polarisation e.m.f. of the solution. The sinusoidal current leads the p.d. owing mainly to the e.m.f. of ionic segregation. When the applied e.m.f. is $>$ the polarisation e.m.f. the wave-forms become non-sinusoidal but with a still higher e.m.f. the sinusoidal form is regained. If the polarisation e.m.f. is not exceeded the equiv. series capacity of a given cell is almost independent of frequency and of e.m.f. The applications of the observations to solvent corrections in conductivity measurements are discussed.

J. W. S.

Amorphous state. X. Conductivity of strong electrolytes in the amorphous state. P. Kobeko, E. Kuvschinski, and N. Schischkin (Acta Physicochim. U.R.S.S., 1937, **6**, 954).—A correction (cf. A., 1937, I, 284).

W. R. A.

Conductance of hydrochloric acid in dioxan–water mixtures from 15° to 45°. B. B. Owen and G. W. Waters (J. Amer. Chem. Soc., 1938, **60**, 2371—2379).—Conductance data follow the Onsager limiting slope in 20 and 45% dioxan at high dilutions; in 70 and 82% dioxan ionic association is too pronounced for convergence with the limiting slope. In a given solvent mixture the temp.-dependence of the limiting conductance is linear; an expression for the variation with viscosity has been derived. The influence of dielectric const. on conductance and ionic association is discussed, and approx. vals. for the heat and entropy of ionisation are reported.

E. S. H.

Conductivity data of aqueous mixtures of hydrogen peroxide and nitric acid. W. H. Hatcher and D. W. MacLauchlan (Canad. J. Res., 1938, **16**, B, 253—259).—Solutions of H_2O_2 and HNO_3 containing $>50\%$ HNO_3 are explosively unstable, but conductivities of mixtures containing $<50\%$ HNO_3 were measured by the static method

(A., 1930, 523; 1932, 1206). The results indicate the formation of one or more unstable peroxides or peracids which cannot ionise. T. H. G.

Conductance of mixtures of lead abietate and tributylammonium chloride in toluene. V. DEITZ and R. M. FUOSS (J. Amer. Chem. Soc., 1938, **60**, 2394—2401).—Conductances of Pb abietate (I) and of $NHBu_3$ picrate and chloride (II) in PhMe at 35° have been determined. The polar moment of (I) in PhMe is 0. The reaction between (I) and (II) has been studied; an intermediate sol. salt Pb(ab)Cl is probably formed. The moment of the corresponding ion pair is $8{\cdot}6 \times 10^{-18}$ and its dissociation const. approx. $1{\cdot}5 \times 10^{-17}$. Pure (I) is prepared by dissolving abietic acid in an equiv. amount of aq. NaOH, and adding to hot, dil. aq. $PbCl_2$ in equiv. amount; the white ppt. is recrystallised from EtOAc. A method for determining Pb in compounds sol. in aromatic hydrocarbons, based on the quant. pptn. of $PbCl_2$ by the action of dry HCl, is described. E. S. H.

Electrical phenomena accompanying the formation of organo-metallic compounds of calcium and aluminium. P. BRUN (Compt. rend., 1938, **207**, 622—623; cf. A., 1936, 1216).—Negligible currents are obtained between Ca and Pt electrodes in Et_2O solutions of org. bromides; with iodides a measurable p.d. and current are observed. Still smaller effects occur with Al, attack of the metal being merely superficial except in presence of CH_2I_2. The currents obtained with Mg, Ca, and Al in Et_2O solutions of PhI are $\sim 1{\cdot}6 \times 10^{-6}$, 10^{-7}, and $< 10^{-7}$ amp., respectively, the sequence corresponding with that of the ionisation potentials. A. J. E. W.

Relation between the number of crystallisation nuclei forming and electrolyte concentration in electrolysis. A. T. WAHRAMIAN and S. A. ALEMIAN (Acta Physicochim. U.R.S.S., 1937, **7**, 95—100).—In the electrolysis of aq. $AgNO_3$ with a Pt cathode and Ag anode, microscopical observation shows that the no. of Ag nuclei forming is inversely $\propto$ $[AgNO_3]$ between 2N. and 0·1N. E. S. H.

Activity coefficient of perchloric acid, and a correction to the value of the argentous-argentic oxidation potential in perchloric acid. D. DEVAULT (J. Amer. Chem. Soc., 1938, **60**, 2561—2562).—Activity coeffs. have been re-calc. from published v.p. data (cf. A., 1933, 1014). The corr. coeffs. lead to vals. of the $Ag^{\cdot}|Ag^{\cdot\cdot}$ potential in 4M-$HClO_4$ of 1·970 v. at 0·2° and 1·987 v. at 25·0°. E. S. H.

Electrode potentials of metals and alloys in (A) nitric acid, (B) copper nitrate solution. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, **17**, 614—641, 680—693).—(A) The single electrode potential of Mg, Al, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, Ag, Cd, Sn, Sb, Ta, W, Pt, Au, Hg, Pb, Bi, C, Si and high-C steel, 13% Cr-stainless steel, stainless steel, brass, monel metal, and nichrome in HNO_3 was determined by the valve potentiometer. A relation between electrode potential and at. no. for the metals and non-metals was found, but the potential val. did not always correspond with the rate of attack. Potential series after 20 min. immersion for 8 concns. in the range 0—60% HNO_3 are given.

(B) Corresponding data for the same substances in 2—20% $Cu(NO_3)_2$ solution are given. N. M. B.

Photo-voltaic effects in Grignard solutions. A. J. HARRISON, D. NIGHTINGALE, and R. T. DUFFORD (J. Amer. Chem. Soc., 1938, **60**, 2450—2452).—There is no e.m.f. between two Mg–Hg or Mg electrodes (cleaned by an org. halide) in solutions of MgPhBr or MgEtBr in Et_2O, and no effect when one electrode is illuminated. There is, however, a light effect when the Mg is not thus cleaned or when it is exposed to air. A film, possibly $Mg(OH)_2$, is responsible for the effect. R. S. C.

Elimination of liquid junction potentials. I. Solubility product of silver chloride from 5° to 45°. B. B. OWEN. **II. Standard electrode potential of silver from 5° to 45°, and related thermodynamic quantities.** B. B. OWEN and S. R. BRINKLEY, jun. (J. Amer. Chem. Soc., 1938, **60**, 2229—2233, 2233—2239).—I. A method for eliminating heterionic liquid junction potentials by extrapolation is proposed. The solubility (in g.-mol. per l.) of electrolytic AgCl in H_2O, derived by this method, is $0{\cdot}505 \times 10^{-5}$ at 5°, $1{\cdot}334 \times 10^{-5}$ at 25°, and $2{\cdot}997 \times 10^{-5}$ at 45°.

II. The above method has been applied to the determination of the standard potential of the Ag electrode at 5° intervals from 5° to 45°. Vals of $\Delta S°$, $\Delta H°$, and $\Delta C_p°$ have been calc. for the electrode reaction at 15°, 25°, and 35°. The solubility products and solubilities of AgCl, AgBr, and AgI have been derived by combination of the normal potentials of the Ag and Ag–Ag halide electrodes. Vals of $\Delta S°$, $\Delta H°$, and $\Delta C_p°$ for the reaction $AgX = Ag^{\cdot} + X'$ at 15°, 25°, and 35° are recorded. A table of relative ionic entropies and heat capacities for $Ag^{\cdot}$, Cl', Br', and I' is given. E. S. H.

Platinum electrode. V. Measurement of the capacity of a smooth platinum electrode when charged with currents of low density. B. ERSCHLER (Acta Physicochim. U.R.S.S., 1937, **7**, 327—338; cf. A., 1938, I, 200).—A smooth Pt electrode has been constructed and has a depolarisation current of 10^{-10} amp. per sq. cm. Charging curves were measured for smooth Pt in the following solutions: N-KBr + 0·03N-HCl; N-HCl; N-Na_2SO_4 + 0·03N-HCl; N-KOH. These are similar to the curves for the platinised Pt electrode and show the dependence of H_2 adsorption on the nature of the electrolyte; the H-binding depends on the anion and increases in the order Br', Cl', SO_4'', OH'. Slow processes occur on the electrode during charging within the double layer region and the possible significance of such processes is discussed. The no. of H atoms per sq. cm. of surface at the reversible H_2 potential approx. = the no. of Pt atoms on the same surface. W. R. A.

Electrolytic polarisation with alternating current. S. M. CHRISTIAN (Physical Rev., 1937, [ii], **51**, 685).—The effects of frequency, distance between electrodes, c.d., temp., nature of solution and electrodes, and superimposed a.c. and d.c. have been investigated. Diffusion of ions from the electrodes

furnishes the best explanation of the observations, and is preferable to the concept of a gaseous film surrounding the electrodes. L. S. T.

Electrolytic reduction of organic compounds at the dropping mercury electrode. A. WINKEL and G. PROSKE (Ber., 1938, **71**, [*B*], 1785—1793; cf. A., 1936, 708, 1233).—Displacements of the depolarisation potential (V) caused by varying temp., concn. of the substrate, or nature or concn. of the added electrolyte are almost within the limits of experimental error. Salts with multivalent cations, however, diminish V, whilst p-$C_6H_4Me{\cdot}SO_3H$ in acid solution increases it. A dominating effect is exerted by the p_H. The reduction of all CO: compounds examined occurs in two steps in the p_H range 3·5—4·5. The V–p_H graphs fall into an "acid" and an "alkaline" branch, superposed over a considerable range, which is uninfluenced by the nature and concn. of the added electrolyte, and is the same for mono- and di-carbonyl compounds and for NO_2-derivatives. Possible causes of the characteristic form of these curves are discussed. It does not depend on a change in the mode of union of the O atom, nor on differences in the final product. It is suggested that the effective reducing agent is metal in alkaline solution and H in acid. H. W.

Observation of the diffusion film in electrolytic deposition. H. J. ANTWEILER (Z. Elektrochem., 1938, **44**, 719—724).—Two forms of apparatus are described which permit photography of the diffusion layer in the vicinity of a dropping Hg cathode in solutions of concn. $<$0·1N and $<$0·002N, respectively. It has been shown that with high c.d. the liquid around the cathode may circulate with a velocity of 5 cm. per sec. J. W. S.

Passivity of metals and surface compounds. L. LEPIN (Acta Physicochim. U.R.S.S., 1938, **8**, 659—668).—The theory of passivity of metals developed by Faraday is extended. The passivity of metals and the indifference of noble metals are due to the formation of surface oxides of high valency which protect the metal from oxidising agents. The smaller is the at. radius of the metal, the less able is it to take part in ordinary vol. reactions and the more readily can it participate in surface chemical actions. W. R. A.

Phenothiazine. IV. Potentiometric characterisation of thionol. F. DE EDS and C. W. EDDY (J. Amer. Chem. Soc., 1938, **60**, 2079—2084; cf. A., 1938, II, 340).—The potentiometric characteristics of thionol have been determined. The existence of a semiquinone is supported by colorimetric evidence. The positions on the oxidation–reduction scale of methylene-blue, Lauth's violet, and thionol are discussed. E. S. H.

Electrometric titration of tannic acids. I. Electrometric titration of ellagic, ellagitannic, and chebulinic acids. II. Electrometric titration of gallic and gallotannic acids. S. R. SUNTHANKAR and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, **A**, 189—207, 209—221).—I. Results of the electrometric titration of ellagic, ellagitannic, and chebulinic acids are in agreement with their known structures, and the behaviour of myrobalan in tanning and the control of the viscosity of clays, although the curves show additional spurious peaks. The first dissociation consts. (K_1) of the acids are $2{\cdot}6 \times 10^{-7}$, $1{\cdot}6 \times 10^{-5}$, and $3{\cdot}16 \times 10^{-6}$, respectively.

II. Gallic acid has K_1 $4{\cdot}6 \times 10^{-5}$ and K_2 $2{\cdot}57 \times 10^{-9}$. Gallotannic acid has K_1 $1{\cdot}32 \times 10^{-5}$, in agreement with Nierenstein's formula modified as follows: $C_6H_2(OH)_3{\cdot}CO_2{\cdot}C_6H_2(OH)_2{\cdot}CO{\cdot}[O{\cdot}C_6H_2(OH)_2{\cdot}CO_2{\cdot}C_6H_2(OH)_2{\cdot}CO]_3{\cdot}O{\cdot}C_6H_2(OH){\cdot}CH(OH){\cdot}O{\cdot}C_6H_2(OH)_2$ (with CO_2 bridging the two terminal groups). F. R. G.

Re-combination of hydrogen atoms. III. I. AMDUR (J. Amer. Chem. Soc., 1938, **60**, 2347—2355; cf. A., 1935, 827).—The fraction of at. H at different distances along the re-combination tube has been measured for different pumping speeds and at 0·276—1·044 mm.; vals. obtained vary from 0·0410 to 0·693. The data have been fitted to a family of empirical curves by the method of least squares, and rate coeffs. have been calc. Various mechanisms involving re-combination by triple collisions are discussed. E. S. H.

Uniform flame propagation. J. B. ZELDOVITSCH and D. A. FRANK-KAMENECKI (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 693—697).—Theoretical. If the velocity of reaction in the equation for flame propagation is expressed as a function of temp. and concn. of the reactants non-linear equations are obtained for the thermal conductivity and diffusion. These equations can be solved if the temp. is expressed as an independent variable in the equation for thermal conductivity and the concn. as an independent variable in the diffusion equation. F. J. L.

Theory of Bunsen flames. L. CHITRIN (Tech. Phys. U.S.S.R., 1937, **4**, 121—137).—A simple expression for the equation of the surface of ignition is deduced. On the theory advanced, the steady part of the ignition surface is the lower ring part of the cone, acting as a continuous ring of ignition. The height of the cone and the dimensions of its lateral surface can be calc. from the ignition surface equations. Various features of the form of the cone are discussed and explained. N. M. B.

Influence of organic radicals on para-hydrogen. G. M. SCHWAB and E. AGALLIDIS (Z. physikal. Chem., 1938, **B**, **41**, 59—70).—The para-H_2 present in equilibrium H_2 is rearranged by CPh_3 in solution, in the same manner and velocity as by paramagnetic mols. with 1·73 Bohr magnetons. This provides a simple method of measuring the concn. of free radicals. The results obtained by this method confirm the osmotic observations that CPh_3 is completely, and $CPh(C_6H_4Ph)_2$ is 80%, dissociated in solution. The absence of steric factors is due to the static distribution of the magnetic moment over the whole radical surface. W. R. A.

Kinetics of the oxidation of hydrogen. N. TSCHIRKOV (Acta Physicochim. U.R.S.S., 1937, **6**, 915—938).—The oxidation of H_2+O_2 (10—95%) has been studied at intervals between 444° and 552° for pressures of from 250 to 600 mm. H_2O acts as an autocatalyst in the reaction. The kinetics of the reaction with excess of O_2 or of H_2 are discussed. When $[O_2]$ is low (5%) the kinetics are very different.

Different mechanisms are postulated at low and at high pressures. W. R. A.

Effect of temperature on the reaction of hydrogen atoms with the wall. G. KORNFELD (Physical Rev., 1937, [ii], **51**, 689).—At 220°, H_2 and Cl_2 combine by a chain reaction similar to the chain mechanism underlying the photochemical reaction at room temp. At 220°, the chains are much more frequently stopped by collisions of the atoms with the wall. It is calc. that at this temp. nearly every collision of a H atom with the wall is effective. L. S. T.

Second pressure limits in gaseous explosion regions. I. Experimental data on H_2–O_2 and H_2–air explosions. A. J. DIJKSMAN (Rec. trav. chim., 1938, **57**, 1059—1074).—The fine structure of the lower pressure limit (using spark ignition) in H_2–O_2 and H_2–air mixtures has been investigated as a function of p below about 100 cm. Between certain compositions (8·4—9·8% H_2 in the H_2–O_2 system) there are an upper and a lower limiting p between which explosions can occur. Indications of this fine structure can be traced in earlier work, and it resembles that of the inflammability regions found at higher temp. F. J. G.

Explosion limit curves. I, II. Systems H_2–O_2–N_2, H_2–O_2–CO_2, H_2–O_2–A. J. J. VALKENBURG (Rec. trav. chim., 1938, **57**, 1097—1108, 1109—1116).—I. The explosion limits for an explosive mixture with a diluent gas may be conveniently represented by a curve on a triangular diagram. Possible forms of curve are analysed mathematically. Experimental results for H_2–O_2 with N_2, CO_2, and A give curves which are approx. hyperbolæ.

II. Further mathematical treatment of the curves is given. F. J. G.

Sensitised explosions. II. Ignition phenomena in mixtures of carbon monoxide and oxygen sensitised by hydrogen. III. Kinetics of ignition of carbon monoxide and oxygen sensitised by hydrogen. E. J. BUCKLER and R. G. W. NORRISH (Proc. Roy. Soc., 1938, **A**, **167**, 292—318, 318—342; cf. A., 1936, 74).—II. The ignition of $2CO+O_2$ mixtures containing small quantities of H_2 occurs at temp. 150° < with the pure gases, combustion being complete if the H_2 content exceeds 0·5%. The region of sensitised ignition is bounded by upper and lower pressure limits; the dependence of the former on temp. and $[H_2]$ was investigated. A study of the ignition of mixtures by compression shows that the primary cause of ignition is the rise of temp. accompanying sudden compression.

III. The dimensions of the reaction vessel have but little influence on the character of the ignition. The variation of the pressure limits of ignition in presence of inert gases, A, He, N_2, and CO_2, suggests that the multiplication of chain carriers may be prevented by collisions of the second kind. The effectiveness of these gases in suppressing ignition is in the order $CO_2>N_2>He>A$. The effect of sensitising the reaction by D_2 is compared with the effect of H_2; the pressure limits are lower in the former case. A mechanism explaining the catalytic effect of H_2 on the combustion is proposed. G. D. P.

Flame of CO and O_2. III. Absolute intensity of the electronic radiation from the flame. H. KONDRATEEVA and V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1937, **6**, 748—754; cf. A., 1936, 1469).—The abs. intensity of the electronic radiation from the flame of CO and O_2 has been measured photometrically in the visible and ultra-violet regions. The rate of the reaction has also been determined, and, taking into account the quenching of the chemiluminescence, it is found that one excited CO_2* mol. is formed for about every 125 mols. of CO_2 at 100 mm. and 740°. This yield of CO_2* mols. is > the equilibrium val. for the temp. of the flame, so that these mols. have a chemical origin. W. R. A.

Thermal explosion of nitrous oxide. J. B. ZELDOVITSCH and B. I. JAKOVLEV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 699).—The limiting temp. for self-ignition of N_2O are 1285°, 1195°, and 1100° K. at 170, 330, and 590 mm., respectively. F. J. L.

Chain theory of the oxidation of phosphorus vapour. I. Comparison of the effect of hydrogen, deuterium, and helium on the lower explosion limit of phosphorus–oxygen mixtures. II. Displacement of the lower limit by ultra-violet light. III. Influence of ultra-violet light on the upper limit. IV. Stable oxidation reaction below the lower limit. V. Transformation of white into red phosphorus by means of ultra-violet light. D. W. KING and E. B. LUDLAM (J.C.S., 1938, 1500—1503, 1503—1511, 1511—1513, 1513—1519, 1519—1521).—I. The efficiencies of H_2, D_2, and He in preventing the explosion chain carriers from reaching the walls are in the ratio 1 : 1·30 : 1·32.

II. Ultra-violet light reduces the lower pressure limit and causes reaction between P and O_2 to occur below the limit. The displacement of the limit decays slowly if explosion of the reaction mixture is delayed; it is a wall effect, due probably to the dissociation of P_4 into P_2.

III. The upper pressure limit is raised by illumination with ultra-violet light; the effect is probably due to the production of P_2 mols.

IV. The rate of the stable reaction $\propto p_{P_4}$ and p_{O_2}, but is independent of the pressure of inert gas.

V. V.-p. measurements show that the rate of transformation of P_4 into red P under ultra-violet light follows a unimol. law. E. S. H.

Inhibition of an explosive reaction in methane–air mixtures. W. P. JORISSEN (Rec. trav. chim., 1938, **57**, 1127—1133).—In discussing the influence of a third gas or vapour on explosive binary mixtures the whole form of the ternary explosion region must be considered. Examples are quoted. F. J. G.

Negative temperature coefficient in the rate of propane oxidation. R. N. PEASE (J. Amer. Chem. Soc., 1938, **60**, 2244—2246).—The rate passes through a min. at 360—380°. At low temp. the steady-state rate is independent of $[O_2]$, but at higher temp. it depends on the concns. of both gases, the powers being between 1 and 2. It is suggested that a low-temp. branched-chain reaction is suppressed in the transition region and gives place to an unbranched chain. E. S. H.

Kinetics of the decomposition reactions of the lower paraffins. II. *iso*Butane. E. W. R. STEACIE and I. E. PUDDINGTON (Canad. J. Res., 1938, **16**, B, 260—272; cf. A., 1938, I, 403).—The kinetics of the thermal decomp. of *iso*-C_4H_{10} have been studied between 522° and 582° and pressures of 5 and 60 cm. An expression given for the first-order reaction coeff. agrees with that given by previous observers. The reaction velocity falls with falling pressure as in *n*-C_4H_{10}. The reaction products are H_2, CH_4, C_2H_4, C_2H_6, C_3H_6, and C_4H_8. T. H. G.

Mechanism of the abnormal influence of temperature on oxidation in mixtures of hydrocarbons with oxygen or air. M. PRETTRE (Compt. rend., 1938, **207**, 576—578).—The anomalous effect of temp. on the rate of oxidation is explained by assuming that the degenerate branching process undergone by the intermediate oxidation product is homogeneous. This assumption is supported by experiments with C_5H_{12} using a reaction vessel of large internal surface, in which the temp. at which the anomaly appears is substantially raised. A. J. E. W.

Influence of the combustion vessel dimensions on the rate of oxidation in pentane–oxygen mixtures. M. PRETTRE (Compt. rend., 1938, **207**, 532—534).—An increase of the interior surface of the reaction vessel with glass rods does not increase the reaction rate, showing that the chain-initiating reaction is homogeneous. The rate const. $\phi = a + b/d^2$ (d = vessel diameter, a and b consts.), indicating a heterogeneous branching reaction. The results are in accord with Semenov's theory, heterogeneous chain-breaking being assumed. A. J. E. W.

Kinetics of thermal decomposition of alkylene oxides. II. Propylene oxide. H. W. THOMPSON and M. MEISSNER (Trans. Faraday Soc., 1938, **34**, 1222—1229; cf. A., 1936, 1208).—The thermal decomp. of (CH_2·$CHMe$)O at 450—500° is quasi-unimol. and homogeneous. It is markedly catalysed by I vapour. A, N_2, and CH_4 do not noticeably affect the velocity. From the temp. coeff. of k the activation energy is calc. to be about 58 kg.-cal. Aldehydes can be detected among the decomp. products, but their proportion is small. The influence of added NO has been studied, and the mechanism of the reaction is discussed. F. L. U.

Effect of heavy water on the velocity of hydrolysis of esters and on the equilibrium constant. II. A. KAILAN and F. EBENEDER (Z. physikal. Chem., 1938, **182**, 397—404; cf. A., 1937, I, 622).—As in the case of the Et esters, substitution of D_2O for H_2O in the hydrolysis of Me, Pr^n, and Bu^n acetates and benzoates in absence of catalyst at 205° does not affect the equilibrium consts. but retards considerably the rate of hydrolysis. The apparent change in the equilibrium const. for MeOAc is due to change in the relative vols. of liquid and vapour, and extrapolation to zero vapour vol. eliminates the discrepancy. J. W. S.

Esterification of benzoic acid with methyl alcohol using isotopic oxygen. I. ROBERTS and H. C. UREY (J. Amer. Chem. Soc., 1938, **60**, 2391—2393).—When BzOH is esterified with MeOH, enriched in ^{18}O, in presence of HCl, the H_2O produced by reaction is of ordinary isotopic composition. Thus, the O of the H_2O originates entirely in BzOH. A small correction is added to the calc. results to allow for slow exchange of the BzOH, which proceeds simultaneously with esterification. E. S. H.

Equilibrium and kinetics of the formation of oxonium compounds. A. T. GLADATSCHEV and J. K. SIRKIN (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 145—148).—The kinetics of the formation of Me_2OHCl from Me_2O and HCl cannot be studied directly since the reaction reaches equilibrium much too quickly, but an indirect method has been used satisfactorily and gives $\Delta H = -7400$, $\Delta S = -28{\cdot}5$, $\Delta F_{25} = 1093$ g.-cal., pointing to the presence of a H bond. The corresponding oxonium bromide is formed from Me_2O and HBr at a measurable velocity, but the reaction is very complicated. T. H. G.

Relation between chemical activity and absorption in the ultra-violet of certain organic molecules. II. Velocity of saponification of chloro-derivatives of substituted amides of malonic acid. K. G. NAIK, R. K. TRIVEDI, and C. M. MEHTA (J. Indian Chem. Soc., 1938, **15**, 426—432; cf. A., 1938, I, 598).—Measurement of the rates of hydrolysis of the compounds investigated in Part I shows that replacement of CH_2 by CCl_2 increases the reactivity and prevents the tautomerism of the unsubstituted malondiamides. The velocity of hydrolysis in relation to the distance of the Me in C_6H_4Me from the ·NH· is $o < m < p$. F. R. G.

Rate and mechanism of hydrolysis of benzhydryl chloride in acetone. W. TAYLOR (J. Amer. Chem. Soc., 1938, **60**, 2094—2096).—The products are $CHPh_2$·OH and HCl only. The rates of hydrolysis and of the reverse reaction have been determined. Assuming that both are second-order reactions, good agreement is noted between the calc. equilibrium positions and those observed for the hydrolysis reaction, with different initial [H_2O]. A bimol. mechanism for both reactions is presumed. E. S. H.

Kinetics and viscosity, two problems of highly polymerised compounds. J. LÖBERING (Z. Elektrochem., 1938, **44**, 743—747).—Polymerisation processes accompanied by pptn. of the polymeride are discussed with respect to the independent velocities and reversibilities of the polymerisation and pptn. processes. The variation of the gross velocity coeff. of the polymerisation of CH_2O with varying [H$^+$] is in accord with the theory. The viscosities of solutions of certain compounds of high mol. wt. which show variations with velocity of flow are changed by exposure to ultra-violet light. This change appears to be irreversible. J. W. S.

Mechanism of racemisation of phenyl-*p*-tolylacetic acid.—See A., 1938, II, 488.

Absorption of carbon dioxide by aqueous solutions of organic bases and salts. A. GUYER and G. PÜRNER (Helv. Chim. Acta, 1938, **21**, 1337—1345).—The readiness of absorption of CO_2 by aq. amine solutions follows the order $NH_2Et > NHEt_2 > NEt_3$, whilst the ease of removal of the absorbed CO_2

follows the reverse order. The rate of absorption of CO_2 by NEt_3 is similar to that by K_2CO_3, but the rate of elimination is much greater with NEt_3. The rate of absorption of CO_2 by $NH_2{\cdot}CH_2{\cdot}CO_2Na$, $NH_2{\cdot}CH_2{\cdot}CO_2K$, and $NH_2{\cdot}CHMe{\cdot}CO_2K$ is $>$ by K_2CO_3 and similar to that by $NHEt_2$, but the rate of removal of the CO_2 is $<$ that from $NHEt_2$ and approx. equal to that from K_2CO_3. In general the higher is the p_H of the solution the easier is the absorption of CO_2 and the more difficult is its removal from the solution. J. W. S.

Oxidation of carbon. S. E. CHAIKINA (Acta Physicochim. U.R.S.S., 1938, **8**, 343—356).—The mechanism of C oxidation has been studied on single C particles, with $[O_2]$ varying from 2·1 to 100%. The reaction proceeds not only at the outer surface of the C, but also inside the whole mass. The sp. oxidation rate increases with temp. according to the Arrhenius law; it is independent of the linear rate of gas flow within the limits 5—30 cm. per sec., and thus is determined by the actual rate of chemical reaction. At high $[O_2]$ the reaction is almost of zero order with respect to the O_2, and approaches first order at low $[O_2]$. The activation energy of the electrode C reaction is 40,000 g.-cal. per mol. at $[O_2] > 10\%$, whilst for charcoal it is 30,000 g.-cal. per mol. These results are discussed in relation to existing theories of C oxidation mechanism. W. R. A.

Rates of hydrogenation of *cis*- and *trans*-isomerides [dibenzoylethylenes].—See A., 1938, II, 495.

Rate of xanthation of soda-cellulose.—See B., 1938, 1277.

Theory of anticatalysis. E. BAUR (Z. physikal. Chem., 1938, **B**, **41**, 179—182).—A discussion. W. R. A.

Homogeneous catalytic hydrogenation. M. CALVIN (Trans. Faraday Soc., 1938, **34**, 1181—1191).—CuOAc and Cu^I salicylaldehyde are catalysts for the homogeneous hydrogenation of Cu^{II} compounds and of *p*-benzoquinone in quinoline solution at about 100°. In the first case the reaction is autocatalytic, and in the second the velocity is const. over the greater part of the range. A mechanism is suggested. In experiments with *p*-H_2 no conversion occurred so long as reducible substrate was present. Reduction by D_2 was 40% slower than with H_2. F. L. U.

Catalytic effect of anions on the rate of dissolution of hydrous alumina by acids. J. P. CLAY and A. W. THOMAS (J. Amer. Chem. Soc., 1938, **60**, 2384—2390).—HCl, HBr, HNO_3, and H_2SO_4 dissolve aged Al_2O_3,xH_2O much less rapidly than do $H_2C_2O_4$, HF, H_3PO_3, or H_3PO_4, although the former acids have greater activity and diffusion coeffs. Dissolution in 0·2M-HCl is accelerated greatly by the presence of 0·001M-F′, -PO_4''', -PO_3''', -C_2O_4'', or -SO_4''. An explanation based on the co-ordination structure of Al_2O_3,xH_2O and the formation of a complex at the solid–liquid interface has been put forward. E. S. H.

Retardation in the oxidation of adrenaline. E. BAUR and M. OBRECHT (Z. physikal. Chem., 1938, **B**, **41**, 167—178).—The retardation in the oxidation of adrenaline caused by inhibitors has been investigated, and the effect of concn. of inhibitors has been determined. They are efficient at great dilution. The inhibiting effects of Cu and Fe salts are compared. W. R. A.

Interaction of sodamide with salts of formic acid. L. H. FREIDLIN and A. I. LEBEDEVA (Compt. rend Acad. Sci. U.R.S.S., 1938, **19**, 701—705).—NaH_2 catalyses the reaction $2HCO_2X = X_2C_2O_4 + H_2$ (X = Li, NH_4, Ca, Zn, Cu, Mn, Ni) more effectively than KOH. As the amount of $NaNH_2$ increases the yield of oxalate decreases and the reaction proceeds according to the equation $2HCO_2X + 2NaNH_2 = X_2CO_3 + NaOH + 2H_2$. The reactions are exothermic and proceed immediately on addition of the $NaNH_2$ to the molten formate. F. J. L.

Catalytic isotopic exchange of gaseous oxygen. II. Exchange reaction of oxygen atoms between oxygen and water vapour on the surface of amorphous silica, quartz glass, asbestos, and pumice. N. MORITA and T. TITANI (Bull. Chem. Soc. Japan, 1938, **13**, 601—607).—The exchange of heavy O between O_2 and H_2O becomes appreciable above 700° on amorphous SiO_2 but is negligible on quartz, asbestos, or pumice at 800°. F. J. G.

Reaction of gaseous hydrogen bromide with nickel in presence of oxygen. Y. URUSHIBARA and O. SIMAMURA (Bull. Chem. Soc. Japan, 1938, **13**, 570—574).—The reaction proceeds in the dark, forming $NiBr_2$ and H_2, but does not occur in absence of O_2. It is probably accelerated by a trace of H_2O, supplied by oxidation of reduced Ni followed by the action of HBr on NiO. E. S. H.

Combined action of radiation and catalyst. I. Influence of ultra-violet light on the catalytic activity of catalysts in the catalytic decomposition of hydrogen peroxide in aqueous solution. L. PISARSHEVSKI, R. KORABELNIK, and E. RINSKAJA (Acta Physicochim. U.R.S.S., 1937, **7**, 261—288).—The catalytic activity of graphite and of PbO_2 in accelerating the decomp. of aq. H_2O_2 is increased by irradiation with ultra-violet light during the catalytic action. With both polished and platinised Pt, however, the light in some cases retards the decomp. These results are discussed with reference to the mechanism of the decomp. of H_2O_2. It is concluded that illumination retards the transfer of electrons between the H_2O_2 mols. and the Pt. J. W. S.

Influence of various admixtures on the activity of nickel formate catalysts. J. ORLOVA (Maslob. Shir. Delo, 1938, No. 4, 9—11).—The activity of Ni catalysts prepared from Ni formate is unaffected by admixture of 0·5—10% of Fe^{II}, Fe^{III}, Al, or Cu formate, or 0·1—5% of $PbSO_4$, and is lowered by 0·5—10% of Zn or Pb formate, 2—10% of Ni or Na sulphate, or $>0·2\%$ of Na_2S or Fe phosphate. R. T.

Catalytic influence of metallic surfaces in alcoholysis. E. BERNER and A. HJULSTAD (Ber., 1938, **71**, 2052—2056).—When *d*-bornyl, CH_2Ph, CHPhMe, $CH_2{\cdot}CH_2Ph$, $CHPh_2$, and *cyclo*hexyl acetates are heated in sealed tubes with MeOH the alcoholysis is much increased by the presence of Pt,

Cu, Ni, brass, or steel, and is in some cases almost quant. Small amounts of H_2O retard the reaction. F. J. G.

Mechanism of the oxidation of carbon monoxide on manganese dioxide. V. Kinetics of the oxidation of carbon monoxide on manganese dioxide at pressures above 30 mm. S. ELOVITZ and S. ROGINSKI (Acta Physicochim. U.R.S.S., 1937, **7**, 295—310; cf. A., 1936, 1076; 1937, I, 36).—Reaction in a $CO + 0{\cdot}5O_2$ mixture on MnO_2 at 0° and 30—500 mm. occurs through activated adsorption of CO on the MnO_2. The velocity of reaction follows the law $dq/dt = ae^{-\alpha q}$. J. W. S.

Catalytic oxidation of ammonia on platinum and on oxidic catalysts. A. VON NAGEL (Z. physikal. Chem., 1938, **B**, **41**, 71—74).—The results of Krauss (A., 1938, I, 317) are discussed. W. R. A.

"Phosphatatic" action of hydrogels. III. Transformation of metaphosphate into orthophosphate under the influence of metal hydroxides and oxides. E. BAMANN and M. MEISENHEIMER (Ber., 1938, **71**, 2086—2089; cf. A., 1938, II, 399).—Aq. $Na_3(PO_3)_3$, when treated at 37° with suspensions of various metal hydroxides and oxides, is converted into orthophosphate, except with $Be(OH)_2$ and $Cd(OH)_2$, at a rate which varies from about 60% change in 24 hr. for Nd and Pr to 2% for Mg. The p_H of the mixtures was kept at 8—9·5 by suitable buffers. At the same temp. and p_H the conversion in the absence of a catalyst is about 0·3% in 24 hr. F. L. U.

Catalytic properties of charcoal. II. Indophenol reaction. J. F. O'BRIEN, V. TKAC, and C. SCHWOB. **III. Comparison of the oxidative properties of various charcoals. Effect of charcoal hydrosols on hydrogen peroxide and oxygen.** J. F. KEEGEL, W. A. SURUDA, and C. SCHWOB (J. Amer. Chem. Soc., 1938, **60**, 2480—2483, 2483—2486; cf. A., 1936, 1076).—II. The catalytic activity of C in the oxidation of a mixture of α-$C_{10}H_7$·OH and p-$C_6H_4(NH_2)_2$ at p_H 4·5 by H_2O_2 to form indophenol (I) has been re-investigated. A similar oxidation takes place in presence of atm. O_2. (I) appears to be formed both in solution and at the surface of the C.

III. The catalase, peroxidase, and oxidase activity and adsorptive properties of C prepared from (*a*) sucrose, (*b*) sucrose–$CO(NH_2)_2$, (*c*) sucrose–$FeCl_3$, and (*d*) sucrose–$FeCl_3$–$CO(NH_2)_2$ and activated at 590—600° have been compared. The order of activity is the same for all the catalytic processes. Electrometric measurements indicate that C sols activate H_2O_2 and O_2. E. S. H.

Raney's nickel [catalyst]. J. AUBRY (Bull. Soc. chim., 1938, [v], **5**, 1333—1338).—The reducing properties of Raney's Ni (I) in aq. media are due to its reaction with H_2O, which is continuous if the formation of a protective $Ni(OH)_2$ layer is prevented by electrodialysis or by the presence of a suitable solvent (aq. $NH_4Cl + NH_3$); under these conditions reduction (*e.g.*, of NO_2', NO_3', ClO_3', MnO_4', Fe''', etc.) proceeds without evolution of H_2. Sabatier's Ni does not react with H_2O; similar reductions occur in aq. $NH_4Cl + NH_3$, but reaction is 5—10 times slower. (I) reduces S_2O_3'', SO_3'', SeO_3'', SeO_4'', AsO_3''', and AsO_4''' in aq. solution. CCl_4 reacts vigorously with (I) at 100°. (I) catalyses the reduction of $KClO_4$ by H_2 under pressure, reduction being slow and incomplete with Sabatier's Ni. (I) and Ni cathodically saturated with H behave electrochemically as reversible H electrodes, showing that the activity of (I) is due to adsorbed H. A. J. E. W.

Decomposition of methane on reduced nickel. M. KUBOKAWA (Rev. Phys. Chem. Japan, 1938, **12**, 90—104).—The reaction velocity at 420—500° and <30 mm. is expressed, in the initial stage, by $dx/dt = k(a - x)/x^n$, where a is the initial amount of CH_4, x the amount decomposed after the time t, and k and n are consts. When the catalyst has been activated by reduction in H_2, $n > 1$, but when the catalyst is used repeatedly without reduction and also at lower temp., $n < 1$. From the val. of n, deductions are made as to the heterogeneity of the catalyst surface. The apparent heat of activation of the catalytic decomp. is 20 kg.-cal. per g. E. S. H.

Kinetics of catalytic hydrogenation of ethylene with nickel. II. Reaction at high temperatures. O. TOYAMA (Rev. Phys. Chem. Japan, 1938, **12**, 115—124; cf. A., 1936, 169).—The rate of reaction at 99—165° is given by $dx/dt = k_1 p_{C_2H_4}/(1 + k_2 p_{C_2H_4})$ when $p_{C_2H_4}$ is const., and by $dx/dt = k_3 p_{H_2}$ when p_{H_2} is const. The dependence of the consts. on temp. and pressure of the reactants shows that the deviation of the equations from those suggested theoretically at lower temp. is due to change in the concns. of the adsorbed reactants. The heat of adsorption of C_2H_4, derived from the temp. coeff. of k_2, is about 15 kg.-cal. per mol. The temp.-independence of k_1 indicates that the true heat of activation for the reaction approx. = the sum of the adsorption heats of both reactants. E. S. H.

Behaviour of catalysts at transition points. II. G. M. SCHWAB and H. H. MARTIN (Z. Elektrochem., 1938, **44**, 724—728; cf. *ibid.*, 1937, **43**, 610).—The catalytic decomp. of EtOH on a Cu_2I_2 surface shows no sudden change in velocity when the temp. is raised above 402°, the transition point of the catalyst. Conversion back into the lower-temp. form of Cu_2I_2, however, is accompanied by an activation of the catalyst. The continuity of behaviour is attributed to the equal particle size of the two forms. J. W. S.

Magnetic transformation and catalytic activity. V. Progress of the catalytic hydrogenation of liquid unsaturated compounds in the neighbourhood of the Curie interval of ferromagnetic catalysts. J. A. HEDVALL and H. BYSTRÖM (Z. physikal. Chem., 1938, **B**, **41**, 163—166; cf. A., 1936, 169).—A slight change in activity of Ni–Cu and Pd–Co catalysts was observed over the Curie interval during the hydrogenation of castor and cottonseed oils. C. R. H.

Nature of catalysers. S. AOYAMA, J. MATSUZAWA, and T. TAKAHASHI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 957—980).—The magnetic transformation point and the point of inflexion of a 75% Ni–Cu alloy, as cast and also after

annealing at 1200°, were determined. Full data for the catalytic effect of each specimen on the hydrogenation of C_2H_4 indicate that the catalytic effect of a ferromagnetic substance is greatly increased at its magnetic transformation point, and if this temp. is lowered the temp. of max. catalytic effect falls correspondingly. The change in the characteristics of catalytic activation and in the activation temp. with alteration of the magnetic transformation point is affected by heat-treatment. Data on delay intervals and alteration of activation with time are given and discussed. The structure of the specimens was determined photomicrographically. N. M. B.

Reduction of ethylene by nickel–molybdenum catalysts. G. M. SCHWAB and H. NAKAMURA (Z. physikal. Chem., 1938, **B**, **41**, 189—198).—The mixed catalyst used in the reduction of C_2H_4, prepared by the reduction of the mixed oxides, consists of MoO_2 and Ni in solid solution with the elementary Mo. The variation of the adsorption and diffusion kinetics from contact to contact indicates that the active constituent of the catalyst is probably the uncryst. Ni, whereas the MoO_2 is present only as an inert impurity, in contrast to the reduction of PhOH. W. R. A.

Catalytic properties of phthalocyanine crystals. M. POLANYI (Trans. Faraday Soc., 1938, **34**, 1191).—The catalytic properties of phthalocyanine previously reported (A., 1936, I, 1213) should not be taken as definitely established, since some preps. are inactive. F. L. N.

Rôle of supersaturation in the recovery of catalysts. S. ROGINSKI (Acta Physicochim. U.R.S.S., 1938, **8**, 376).—Erratum (cf. A., 1937, I, 35).

Activity of mixed catalysts in gasification of wood charcoal by means of water vapour.—See B., 1938, 1253.

Dehydrogenation of lower paraffins over activated alumina catalysts.—See B., 1938, 1264.

[Catalytic] dehydropolymerisation of ethylene.—See B., 1938, 1264.

[Catalytic] olefine hydrogenation.—See B., 1938, 1264.

[Catalytic] synthesis of toluene from benzene and carbon monoxide.—See B., 1938, 1256.

Action of hydrogen peroxide on aromatic compounds in presence of catalysts.—See B., 1938, 1265.

Polymerisation of ethylene with compounds of aluminium as catalyst.—See A., 1938, II, 467.

Condensation of arylhalogenomethanes.—See A., 1938, II, 477.

Catalytic hydrogenation of essential oils.—See B., 1938, 1362.

Separation of alkaline-earth carbonates from aqueous solutions. E. THEISZ (Tech. Kurir, 1938, **9**, 71—74).—Electrolysis of alkaline-earth formates yields the corresponding hydroxides and H_2 at the cathode and CO_2 and H_2O at the anode. Using a.c., carbonates are formed at both electrodes. Graphs showing the influence of concn., temp., and c.d. on the formation of $BaCO_3$ are given. E. P.

Electrodeposition of chromium from tervalent salt solutions.—See B., 1938, 1312.

Electrodeposition and refining of bismuth.—See B., 1938, 1313.

Electrodeposition of metals from non-aqueous solutions.—See B., 1938, 1312.

Anodic and ordinary corrosion of ferrous metals in various acids.—See B., 1938, 1307.

Preparation of iron phosphides by electrolysis at high temperature. M. CHÊNE (Compt. rend., 1938, **207**, 571—573; cf. A., 1938, I, 407).—P_2Fe, PFe, PFe_2, PFe_3, and solid solutions of intermediate composition have been prepared by electrolysis at 750—1050° of mixtures of $NaPO_3$, NaF, and Fe_2O_3, using C electrodes and 15—30 amp. at 5 v. Phosphides of high Fe content are obtained using a high $[Fe_2O_3]$ and substituting $Na_4P_2O_7$ for $NaPO_3$, a high temp. being favourable. A low $[Fe_2O_3]$ and addition of P_2O_5 or HPO_3 gives a high P content. PFe_2 and P_2Fe are resistant to acids, except aqua regia; PFe_3 is attacked by acids. P_2Fe and PFe_3 are slowly oxidised in air. A. J. E. W.

Reduction of aconitic acid at the dropping mercury cathode.—See A., 1938, II, 471.

Oxidation reactions at the positive pole in spark electrolysis. P. DE BECO (Compt. rend., 1938, **207**, 623—625).—No peroxides are produced in the electrolysis of metallic salt solutions by sparking, H_2O_2 being formed at the positive pole. The yield is high with SO_4'', NO_3', OAc', and H_2PO_4', but lower with Cl′ owing to the instability of H_2O_2 in presence of halogen acids; at $p_H > 7$ the yield falls with increasing p_H. A higher yield is obtained in an atm. of O_2 than with H_2. A. J. E. W.

Mechanism of the recombination of OH radicals in the electric discharge. V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1938, **8**, 315—322; cf. A., 1937, I, 493).—The triple collision mechanism $2OH + M = H_2O_2 + M$ agrees best with the known experimental and theoretical data on the rate of disappearance of OH radicals in the zone of an electric discharge in water vapour. The inability to detect the H_2O_2 formed is attributed to secondary reactions with either H or OH, leading to its decomp. W. R. A.

Decomposition and synthesis of hydrogen iodide by α-particles. K. G. BRATTAIN (J. Physical Chem., 1938, **42**, 974).—A correction in an equation (cf. A., 1938, 1, 409).

Action of hydrogen peroxide on the photographic film. A. BERTHOUD and M. CRUCHAUD (Helv. Chim. Acta, 1938, **21**, 909—912).—During decomp. of H_2O_2 no radiation which affects a photographic film is produced. The action of H_2O_2 on the film is attributed to the formation of Ag nuclei, by autoreduction of either Ag_2O or AgBr. After immersion in H_2O_2 and subsequent development the blackening of the film is never great, and physical development yields scarcely any blackening. The effect of H_2O_2 in alkaline solution is > in neutral or

acid solution. After a film has been treated with HCl, HNO_3, or aq. NH_3 and then washed its sensitivity to H_2O_2 is greatly reduced. 0·01N-$AgNO_3$ has no appreciable sensitising action unless the film is afterwards washed with 0·01N-NaOH. A saturated solution of Ag_2O has also no sensitising action, but 0·01N-$Ag(NH_3)_2OH$ or -$Ag(NH_3)_2Cl$ greatly increases the sensitivity. J. W. S.

Photochemical investigations in the Schumann ultra-violet. VII. Photochemistry of carbon monoxide. K. FALTINGS, W. GROTH, and P. HARTECK (Z. physikal. Chem., 1938, **B**, **41**, 15—22).—The photochemical decomp. of CO by the Xe resonance lines 1295 A. and 1470 A. has been investigated. The shorter λ only is photochemically active and a quantum yield of 1 is observed; the reaction products are CO_2 and C_3O_2. The suggested mechanism is $CO + h\nu = C + O$ (*a*); $CO + O (+ M) = CO_2 (+ M)$ (*b*); $2CO + C = C_3O_2$ (*c*). The heat of dissociation of CO probably lies between 219 and 193 kg.-cal. Using H_2–CO mixtures the reaction products contain CH_2O, H_2O, and H_2O_2, and a postulated mechanism depends on the formation of HCO: $CO + h\nu = CO^*$ (i); $CO^* + H_2 = CO + 2H$ (ii); $H + CO = HCO$ (iii); $HCO + O_2 = HO_2 + CO$ (iv). The HO_2 yields H_2O_2 and H_2O. This postulate is verified by experiments using Hg-sensitised radiations with H_2–CO mixtures to which a trace of O_2 is added. W. R. A.

Photolysis of carbonic acid. E. BAUR, K. GLOOR, and H. KÜNZLER (Helv. Chim. Acta, 1938, **21**, 1038—1053; cf. A., 1937, I, 318; II, 513).—The yields of CH_2O obtained from rhodamine 3B, carried in resin, in presence of various "redox" materials and from various esters of rhodamine B in presence of $FeCl_3$, when irradiated by the Baur–Fricker method, have been determined. No CH_2O is obtained with the free acid. The nature of the esterifying group is of secondary importance, but large groups are advantageous. CH_2O is also obtained from rhodamines and chlorophyll (I) in presence of redox materials in non-aq. solutions (alcohols and phenols). Irradiation of an emulsion of pulverised leaves and geraniol in H_2O saturated with CO_2 and buffered with $CaCO_3$ gives higher yields of CH_2O and is claimed to produce synthesis of CH_2O *in vitro*. Improved yields are also obtained from (I) carried on acetate silk impregnated with C_8H_{18} + cetyl alcohol and immersed in aq. methylene-blue (II) when the solution is saturated with CO_2. CH_2O is also obtained when acetate silk is dyed with other dyes and soaked in C_8H_{18} + cetyl alcohol and immersed in (II) saturated with CO_2. J. W. S.

Photochemical formation of carbonyl chloride. XII. Photochemical formation of carbonic acid from carbon monoxide and oxygen, sensitised by chlorine. Existence of the equilibrium CO + Cl ⇌ COCl in the photochemical formation of carbonyl chloride and its disturbance by means of oxygen. XIII. Photochemical formation of carbonic acid from carbon monoxide and oxygen, sensitised by chlorine. Reactions resulting from the COCl radical. W. BRENSCHEDE (Z. physikal. Chem., 1938, **B**, **41**, 237—253, 254—286; cf. A., 1938, I, 408).—XII. Previous work on the equilibria involved in the formation of $COCl_2$ is reviewed. In addition to $COCl_2$ and CO_2 formed by the action of light on mixtures of $CHCl_3$, CO, O_2, and Cl_2, Cl, CCl_3, and COCl are formed as intermediates. Equations are derived and a method is described by means of which the equilibrium involved in the formation of these intermediates, viz., $CO + Cl \rightleftharpoons COCl$, has been studied. The data support the earlier theories discussed.

XIII. The reactions $CO + Cl_2 \rightarrow COCl_2$ and $CO + 0{\cdot}5O_2 \rightarrow CO_2$, brought about by the action of light on mixtures of CO, O_2, and Cl_2, have been investigated under various conditions and the data are recorded. The const. A in the expression $\Delta[CO_2]/\Delta[COCl_2] = A[O_2]/[Cl_2]$ is independent of light intensity but increases with increase in total pressure, approaching a limiting val. at a few atm., and decreases with rise of temp. The thermal data support the theory that the formation of CO_2 from O_2 and COCl proceeds by way of CO_3Cl, which decomposes unimolecularly into CO_2 and ClO, the latter decomp. further into O and Cl. The equilibrium $COCl + O_2 \rightleftharpoons CO_3Cl$ proceeds from left to right or from right to left according to whether the temp. is $<$ or $>200°$. C. R. H.

Experimental study of the latent image formation by means of interrupted and Herschel exposures at low temperature. Measurements of reciprocity law failure at low temperature. J. H. WEBB and C. H. EVANS (J. Opt. Soc. Amer., 1938, **28**, 249—263).—Intermittent exposures at liquid air temp. with warming up intervals between exposures indicate that changes vital to the photographic process take place during the warming up periods. White light and Herschel exposures have also been made under a variety of temp. conditions and lead to radically different results. The failure of the low-intensity reciprocity law has disappeared at −78° and that of the high-intensity law at −186°. The results can readily be explained on Gurney and Mott's theory (A., 1938, I, 260). T. H. G.

Theory of the Schwarzschild effect. I. A. NARATH (Z. wiss. Phot., 1938, **37**, 162—192).—Previous theories and mathematical representations of reciprocity law failure are discussed in detail and criticised. Errors in previous theories are shown to be due to erroneous conclusions from the data. The Schwarzschild exponent p, in $I.t^p = \text{const.}$, varies with different densities and is not related to the γ. The failure is greater with more sensitive emulsions, but this is not connected with the relation also found to grain-size. The law failure, contrary to Webb's conclusions (J. Opt. Soc. Amer., 1935, **25**, 4), varies with λ. Webb's results for variation of failure with temp., largely agreeing with Sheppard (B., 1936, 384), prove characteristic minima in the I–$I.t$ curves, but the assumption that the lack of these at low temp. is due to the disappearance of one of two opposite effects cannot be maintained. It is suggested that if data for very low intensities were obtained, the low temp. curves would rise again and thus show the same minima as the curves for higher temp. Reciprocity law failure at high intensities is considered to be a

surface effect, deviations of low intensities being ascribed to absorption effects (uniform or selective). J. L.

Action of light and Runge's capillary images. R. E. LIESEGANG (Z. wiss. Phot., 1938, **37**, 160—162).—Runge's rings, produced by allowing drops of 5% $Co(NO_3)_2$ to fall on filter-paper impregnated with 2% aq. K_2CrO_4 and dried, are largely inhibited if the paper is exposed to daylight (for 1 hr.) before treatment with the Co solution. If part only of the paper is exposed, the rings extend from the unexposed part a little way into the exposed side; the effect is therefore a nuclear one. The rhythmic ring formation is controlled by the periodicity of application of the drops, but if the solution is sucked up from one edge of the paper, some periodicity is observed, due to the spacing of the pores of the paper; both diffusion and capillary phenomena are therefore involved. J. L.

Mercury-photosensitised decomposition of ethane. II. Production of hydrogen and the mechanism of reaction. E. W. R. STEACIE and N. W. F. PHILLIPS. **III. The reaction in presence of added deuterium.** E. W. R. STEACIE, W. A. ALEXANDER, and N. W. F. PHILLIPS (Canad. J. Res., 1938, **16**, B, 303—313, 314—318; cf. A., 1938, I, 366).—II. The Hg-photosensitised decomp. of C_2H_6 using a continuous flow system for rapid removal of the products leads to considerable production of H_2. The reaction is considered to involve firstly a C–H fission and to consist of the following processes: $C_2H_6 + Hg\,(^3P_1) = C_2H_5 + H + Hg\,(^1S_0)$ (I); $H_2 + Hg\,(^3P_1) = 2H + Hg\,(^1S_0)$ (II); $H + C_2H_6 = CH_4 + CH_3$ (III); $H + C_2H_6 = C_2H_5 + H_2$ (IV); $2CH_3 = C_2H_6$ (V); $CH_3 + C_2H_5 = C_3H_8$ (VI); $2C_2H_5 = C_4H_{10}$ (VII); $2H = H_2$ (VIII). The conclusion that (III) is faster than (IV) leads to a revision of the activation energy for (IV) to approx. 9 kg.-cal.

III. Using C_2H_6–D_2 mixtures, the products were separated by low-temp. fractional distillation and the D content of each determined. The CH_4, C_3H_8, and C_4H_{10} obtained were considerably, and the residual C_2H_6 only slightly, deuterised. It is concluded that there are rapid exchanges between CH_3 and D_2 and C_2H_5 and D_2 and that since $C_2H_5 + H = C_2H_6$ and $C_2H_5 + H_2 = C_2H_6 + H$ do not occur to any great extent the low quantum yield of the reaction (approx. 0·1) cannot be due to re-formation of C_2H_6. F. H.

Quantum yield of chloroacetic acid hydrolysis. W. G. LEIGHTON, R. N. SMITH, and P. A. LEIGHTON (J. Amer. Chem. Soc., 1938, **60**, 2566).—The quantum yield in the $UO_2C_2O_4$ and $CH_2Cl{\cdot}CO_2H$ actinometers at λ 2537 A. appears to be $\ll 1$. E. S. H.

Photochemical decomposition of adsorbed acetone. V. KUDRJAVTZEVA and N. PRILESHAEVA (Acta Physicochim. U.R.S.S., 1938, **8**, 211—226).—The photochemical decomp. of $COMe_2$ adsorbed on Bi and Sb layers has been investigated in the ranges 3200—2500 A. and <1950 A., in which $COMe_2$ absorbs, by irradiating a thin mirror of the metal on which the $COMe_2$ is adsorbed. The rate at which the mirror is removed by the free CH_3 produced by photochemical decomp. of $COMe_2$ at different parts of the spectrum was determined. In both λ ranges the absorption limit was displaced in the direction of longer λλ compared with gaseous $COMe_2$, the displacement being caused by a decrease of the distance between the electronic levels in the adsorbed mols. A. J. M.

Primary photochemical reactions. X. Photolysis of cyclic ketones in the gas phase. XI. Photolysis of aldehydes and ketones in paraffinoid solution. XII. Effect of temperature on the quantum yield of the decomposition of di-*n*-propyl ketone in the vapour phase and in solution. C. H. BAMFORD and R. G. W. NORRISH (J.C.S., 1938, 1521—1531, 1531—1543, 1544—1554; cf. A., 1935, 1468).—X. *cyclo*Hexanone and suberone decompose by type I reactions yielding CO and olefines (cf. A., 1935, 713). The decomp. of 3- and 4-methyl*cyclo*hexanones is mainly of type I, but also exhibits a new type, yielding a diolefine and an aldehyde. 2-Methyl*cyclo*hexanone and menthone decompose by type II reactions. The similarity of these type II reactions to that shown by the straight-chain CO compounds is strong evidence against the participation of free radicals in this type of reaction.

XI. The photolysis of COMeEt, $COEt_2$, $COMeBu^a$, $COPr^a_2$, MeCHO, *n*-but-, *iso*valer-, and crotonaldehyde in medicinal paraffin and in *iso*octane has been studied. The primary process can be differentiated into two types analogous to those observed for the vapour, but the course of type I reactions in the case of ketones is modified by secondary changes in solution, due to free radicals produced in the reaction becoming hydrogenated at the expense of the solvent at 70—100°. At room temp. the type I reaction is suppressed completely, owing to re-combination of the free radicals in accordance with the Franck–Rabinowitch principle. In confirmation of earlier views as to the mechanism of photolysis, it is found that those reactions which yield mols. rather than free radicals occur as readily at or below room temp. as at 100°.

XII. The quantum yields of type I and type II decomp. in the gaseous phase are practically independent of temp. (0—100°), but in solution the quantum yield of type I rises from almost 0 at room temp. to 0·3 at 100°. The quantum yield of type II decomp. in solution is affected to a smaller extent by temp. The results are explained in terms of the Franck–Rabinowitch principle, and a quant. treatment is given. At low temp. in solution the alkyl and acyl radicals produced in type I decomp. mainly recombine, but stabilisation, and consequently photolysis, occur at higher temp. through hydrogenation of the radicals, or decomp. of the acyl group. Calc. energies of activation for the hydrogenation and decomp. reactions are 12·3 and 17 kg.-cal., respectively. F. S. H.

Photochemical studies. XXVIII. Photochemical decomposition of methyl ethyl ketone by wave-lengths from 1850 to 2000 A. V. R. ELLS and W. A. NOYES, jun. (J. Amer. Chem. Soc., 1938, **60**, 2031—2036).—Decomp. at room temp. with mainly λ 3130 A. yields approx. 11% of diketones. With λλ 1850—2000 A. the quantum yield of CO increases from 0·70 to 0·88 as the pressure decreases from 90 to 0·1 mm.; diketones are also formed in this spectral region, and the formation of Ac_2 is shown

spectroscopically. The total quantum yield of decomp. with $\lambda\lambda < 2000$ A. is approx. 1 at low pressures when allowance is made for diketone formation. At higher temp. CH_4 is formed, but at room temp. the hydrocarbon products are C_2H_6, C_3H_8, and C_4H_{10} in approx. equal amounts. Possible secondary reactions are discussed. E. S. H.

Behaviour of acetylacetone on irradiation.—See A., 1938, II, 472.

Photolysis of mercaptans. M. MEISSNER and H. W. THOMPSON (Trans. Faraday Soc., 1938, **34**, 1238—1239).—There is a decrease of pressure when EtSH vapour is irradiated with the ultra-violet emission from a Hg arc. A yellow oil, probably Et_2S_2, is formed, and the gaseous products are chiefly H_2 with about 10% of C_2H_6 and traces of unsaturated hydrocarbons. The main reaction is considered to be $2EtSH = Et_2S_2 + H_2$, with a side reaction $EtSH = C_2H_6 + S$. Alkyl mercaptans are unsuitable for detailed study. F. L. U.

Reaction and energy consumption of fructose in the short and medium wave-length ultra-violet regions. G. EHRHARDT (Helv. Chim. Acta, 1938, **21**, 985—1003).—The absorption spectrum of aq. solutions of fructose comprises the superimposed spectra of the keto- and cyclic forms, both of which undergo photochemical decomp. Especially in conc. solutions the reaction velocity in the short ultra-violet region decreases when the solution is kept, this being interpreted as due to the formation of stable mol. complexes. The quantum yield decreases with increasing concn. J. W. S.

Action of light on porphyrins. II.—See A., 1938, II, 461.

Photosynthesis.—See A., 1938, III, 1063.

Action of β-rays of radium on organic acids, especially maleic acid.—See A., 1938, III, 1044.

Ultrasonic waves in chemistry. G. SCHMID (Z. Elektrochem., 1938, **44**, 728—742).—The effects of ultrasonic waves in coagulating suspensions, producing dispersions, degassing liquids, and promoting reactions through activation of O_2 are described. The potentials required for the electrolytic liberation of H_2, Cl_2, and O_2 are reduced by ultrasonic waves, which also destroy the passivity of Fe and, when applied during crystallisation, decrease the grain-size in metals. The effects of ultrasonic waves in causing refraction of light waves are also described. Possible applications in chemical processes and in material testing are discussed. J. W. S.

Detonation of nitrogen trichloride by supersonic waves. V. BOBOLEV and J. CHARITON (Acta Physicochim. U.R.S.S., 1937, **7**, 416).—NCl_3, contained in a thin-bottomed glass vessel, was immersed in oil 2 cm. from the oscillating crystal and detonated after about 10 sec. exposure. W. R. A.

Reactions in the solid state. W. E. GARNER (Sci. Progr., 1938, **33**, 209—229).—A review.

Lithium phosphide. C. LEGOUX (Compt. rend., 1938, **207**, 634—636).—$LiPH_2,4NH_3$ (I) is prepared as a white cryst. powder (cubic) by the action of PH_3 on a solution of Li in liquid NH_3. Hydrolysis of (I) gives PH_3, NH_3, and LiOH. A. J. E. W.

Reactions between dry inorganic salts. IV. Reactions below the fusion point. H. L. LINKE and L. J. WOOD (J. Amer. Chem. Soc., 1938, **60**, 2320—2325; cf. A., 1936, 1216).—Double decomp. reactions involving Na, K, Rb, Cs, Cl, Br, and I have been investigated at 400—500° and the products examined by *X*-ray analysis. When the combinations large cation + small anion and large anion + small cation were heated at 400° for 36 hr., reaction proceeded to some extent towards the stable pairs in 16 of the 18 reactions. When the stable pairs were heated at 400° for 36 hr., reaction proceeded to some extent towards the reciprocal pairs in 7 cases. One reaction proceeded partly towards the stable pair when subjected to 3500 atm. per sq. in. for 10 min. E. S. H.

Reduction of silver ions by means of hydrogen adsorbed on silica gel. L. G. MAJDANOVSKAJA (Acta Physicochim. U.R.S.S., 1938, **8**, 258—260).—Purified SiO_2 gel treated with H_2 at 500° will reduce $AgNO_3$, but the amount of $Ag^{\cdot}$ deposited is not equal to the equiv. of the total H_2 adsorbed by the gel. Similar results were obtained with the replacement of $Na^{\cdot}$ from NaCl solution. SiO_2 gel which has adsorbed H_2 at room temp. contains no active H and is unable to reduce $AgNO_3$. A. J. M.

Reaction of some anhydrous [metallic] chlorides with anhydrous acetic acid and formic acid. H. FUNK and F. RÖMER (Z. anorg. Chem., 1938, **239**, 288—294).—Anhyd. $BeCl_2$, $MgCl_2$, $CaCl_2$, and $SrCl_2$, when warmed with anhyd. HCO_2H, afford the anhyd. formates, with evolution of HCl. With anhyd. AcOH, $BeCl_2$ affords $Be_4O(OAc)_6$ on heating; $MgCl_2$ at room temp. yields $MgCl_2,6AcOH$, as found by Quinet (A., 1937, I, 256), but the product on heating is the *compound*, $Mg(OAc)_2,2AcOH$, and not $Mg(OAc)_2,1{\cdot}5AcOH$; $CaCl_2$ and $SrCl_2$ yield the *compounds*, CaCl(OAc), CaCl(OAc),AcOH, and SrCl(OAc). $ZnCl_2$ dissolves in anhyd. AcOH with evolution of HCl, but the solution cannot be crystallised. $BaCl_2$, $CdCl_2$, and $HgCl_2$ do not react with anhyd. AcOH. F. J. G.

Reactions in the solid state at higher temperatures. XX. Formation of anorthite and gehlenite by reaction in the solid state. W. JANDER and J. PETRI (Z. Elektrochem., 1938, **44**, 747—754).—The synthesis of gehlenite ($2CaO,Al_2O_3,SiO_2$) (I) and anorthite ($CaO,Al_2O_3,2SiO_2$) (II) in the solid state occurs through the intermediate production of $12CaO,7Al_2O_3$ (III), CaO,Al_2O_3 (IV), β-$2CaO,SiO_2$ (V), and CaO,SiO_2 (VI). (I) is formed rapidly by interaction of (III) with SiO_2 and of (V) with Al_2O_3, but the combination of (IV) and (VI) is slow. (I) can also be produced by reaction in the solid state between sillimanite (Al_2O_3,SiO_2) and CaO. Interaction of (I) with more SiO_2 yields (II) and (VI). (II) is also formed by interaction of (I) with Al_2O_3 and SiO_2. Other possible modes of formation of (II), *e.g.*, interaction of (IV) with SiO_2, are very slow. Kaolin ($Al_2O_3,2SiO_2,2H_2O$) reacts readily with CaO, however, to yield (II). J. W. S.

Reaction of chromates at high temperatures. IV. Decomposition of mixtures of calcium chromate with calcium carbonate. V. Decomposition of strontium chromate. VI. Decomposition of mixtures of strontium chromate and strontium carbonate. V. T. ATHAVALE and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 119—129, 759—167, 179—188; cf. A., 1938, I, 155).—IV. When $CaCrO_4$ and $CaCO_3$ are heated together at low pressures the intermediate stages 33·3% and 40% decomp. can be detected, corresponding with the formation of the compounds $9CaO,4CrO_3,Cr_2O_3$ and $17CaO,6CrO_3,2Cr_2O_3$, already observed in the acid-sol. portions from the 66·6% and 75% stages.

V. $SrCrO_4$ begins to decompose at approx. 900° in vac., the heat of dissociation being 51·5 kg.-cal. per g.-mol. of O_2. It melts at 1200°. Intermediate stages occur at 50%, 66·6%, and 75% decomp., and are stable at 0·2 mm. over the ranges 930—1200°, 1225—1300°, and 1325—1450°, respectively. The *compounds* formed are respectively $8SrO,4CrO_3,2Cr_2O_3$ (I), $3SrO,CrO_3,Cr_2O_3$ (II), and $8SrO,2CrO_3,3Cr_2O_3$ (III). With warm AcOH (I) and (II) afford respectively $8SrO,4CrO_3,Cr_2O_3$ and $9SrO,4CrO_3,Cr_2O_3$; (III) is not affected.

VI. When $SrCrO_4$ and $SrCO_3$ are heated together dissociation begins at a lower temp. than for either alone, the gas containing CO_2 and O_2 in an approx. const. ratio 2 : 1. Intermediate stages at 25%, 33·3%, and 40% decomp. can be recognised, the products in the last two being
$8SrO$(or $9SrO$)$,4CrO_3,Cr_2O_3$ (cf. above) and
$17SrO,6CrO_3,2Cr_2O_3$. F. J. G.

Preparation of calcium phosphide.—See B., 1938, 1292.

Effect of alkalinity and impurities on stability of calcium hypochlorite.—See B., 1938, 1292.

Reactions of chromates at high temperatures. VII. Decomposition of barium chromate, and of mixtures of barium chromate with barium carbonate. V. T. ATHAVALE and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, **21**, A, 273—283).—The dissociation pressures of $BaCrO_4$ from 1240° to 1365° have been determined. The heat of decomp. is 49·6 kg.-cal. per g.-mol. of O_2. $BaCrO_4$ melts with complete decomp. at 1400°, but when it is heated at 1265°/<0·2 mm. the decomp. ceases at 50%, the product being $8BaO,4CrO_3,2Cr_2O_3$. This is stable at 1420°. Acids extract $8BaO,4CrO_3,Cr_2O_3$. Mixtures of $BaCrO_4$ and $BaCO_3$ decompose more readily than either substance alone or than the corresponding Sr mixtures, and stages at 25%, 33%, and 40% can be observed, corresponding with $12BaO,6CrO_3,Cr_2O_3$, $9BaO,4CrO_3,Cr_2O_3$, and $17BaO,6CrO_3,2Cr_2O_3$. Dissociation pressures from 760° to 980° are given. The heat of decomp. is 45·1 kg.-cal. per g.-mol. F. J. G.

Metallic amides and metallic nitrides. IV. Zinc nitride. R. JUZA, A. NEUBER, and H. HAHN (Z. anorg. Chem., 1938, **239**, 273—281).—The optimum temp. for the prep. of Zn_3N_2 from Zn dust and NH_3 is 600°, as it decomposes at higher temp. Specimens so obtained are greyish-black and relatively stable to air. They have ρ_4^{25} 6·22 and give a sharp *X*-ray diagram corresponding with the Mn_2O_3 lattice (space-group T_h^7) with a 9·77 A. Specimens prepared from $Zn(NH_2)_2$ are black, less dense, almost amorphous to *X*-rays, and slowly decompose in air. Zn_3N_2 dissolves in dil. HCl, H_2SO_4, and NaOH; it oxidises slowly in O_2 at 400° and ignites at 730°; in H_2 it evolves NH_3 slowly at 400° and rapidly at 600°, and it decomposes in NH_3 above 600° and at a lower temp. in N_2. $\chi_s = -0{\cdot}30$ and the heat of formation is 5·3 kg.-cal. per g.-mol. F. J. G.

Isothermal dehydration of double salts of the schönite type: *X*-ray investigation. H. HÖLEMANN (Z. anorg. Chem., 1938, **239**, 257—272).—In the isothermal dehydration of double salts, $M^I_2SO_4,M^{II}SO_4,6H_2O$, no intermediate stages can be detected by means of *X*-rays. The salts fall into two classes differentiated by the nature of the final product, which for the K Zn, NH_4 Zn, NH_4 Co, and Tl^I Ni salts is obtained at once in the cryst. state and is the anhyd. double salt $M^I_2SO_4,M^{II}SO_4$ (I), whereas for the other salts the final product is amorphous at first when formed at low temp. and at 150° crystallises as langbeinite, $M^I_2SO_4,2M^{II}SO_4$ (II) with separation of $M^I_2SO_4$. Correspondingly, (I) can be crystallised from K_2SO_4–$ZnSO_4$ melts, but not from K_2SO_4–$MgSO_4$ melts. (II) cannot be obtained by heating the finely-ground components at 360°. The different behaviour of the two groups is discussed with reference to ionic radii and the types of double salt which crystallise from solutions. F. J. G.

Boron hydrides. X. Preparation and preliminary study of the new compound B_2H_7N. H. I. SCHLESINGER, D. M. RITTER, and A. B. BURG (J. Amer. Chem. Soc., 1938, **60**, 2297—2300; cf. A., 1938, I, 207).—The prep. of B_2H_7N, m.p. −66·5°, b.p. 76·2°, by the action of B_2H_6 on $B_2H_6,2NH_3$ is described. B_2H_7N is readily hydrolysed in acid solution, and decomposes on warming, yielding B_2H_6 and an unidentified solid. It reacts with NMe_3; with NH_3 the product is a stable solid, B_2H_7N,NH_3, which yields $B_3N_3H_6$ when heated at 200°, and reacts with Na in liquid NH_3 giving $NaNH_2,B_2H_7N$. The properties are in accordance with the proposed structure $BH_2{\cdot}NH_2{\cdot}BH_3$. E. S. H.

Separation of carbon isotopes by diffusion. P. CAPRON, J. M. DELFOSSE, M. DE HEMPTINNE, and H. S. TAYLOR (J. Chem. Physics, 1938, **6**, 656).—With a battery of 51 Hertz-type diffusion pumps the separation factors for C isotopes in CO_2–A and CO_2–N_2 mixtures are respectively 2·4 and 5·4. From these data the separation factor for CH_4 is calc. as 1·18. After 30 hr. pumping 300 c.c. of CH_4 at 1·8 mm. Hg were obtained having 30—32% ^{13}C as indicated by the relative intensities of the Swan bands. W. R. A.

Raman spectroscopic investigations. XII. Constitution of the acids of elements of group V of the periodic system. III. Preparation and constitution of orthonitric acid. A. SIMON [with H. HÖPPNER] (Kolloid-Z., 1938, **85**, 8—15).—Liquid HNO_3 contains NO_2OH mols. and gives evidence of partial decomp. into N_2O_5. The spectrum of liquid HNO_3,H_2O is similar. On solidification NO_2OH passes into $H[NO_3]$, and NO_2OH,H_2O into

$[H,H_2O][NO_3]$. No evidence of the existence of an ortho-acid was obtained. E. S. H.

Action of antimonious anhydride and antimony sulphide on thiol acids.—See A., 1938, II, 471.

Interchange reactions of oxygen. III. Interchange of oxygen between water and acetic acid. J. B. M. HERBERT and I. LAUDER (Trans. Faraday Soc., 1938, **34**, 1219—1221; cf. A., 1938, I, 251).—In experiments lasting up to 166 hr. no exchange of O between $H_2{}^{18}O$ and AcOH, KOAc, and NH_4Ac, respectively, is detectable. It is thus considered certain that hydration of the acid to the ortho form does not occur. F. L. U.

Alkyl thiosulphites. III. Thiosulphurous acid as intermediate product in Wackenroder's reaction. H. STAMM and H. WINTZER (Ber., 1938, **71**, [*B*], 2212—2219; cf. A., 1937, II, 480).—During acid (HNO_3, $HClO_4$) hydrolysis of $Me_2S_2O_2$ in presence of $AgNO_3$ a brick-red *compound* Ag_2S,Ag_2SO_3 is pptd., the formation of which indicates that $H_2S_2O_2$ decomposes thus: $H_2S_2O_2 = H_2S + SO_2$. Mixtures of $Me_2S_2O_2$ and aq. HI give an immediate ppt. of I and S. Since none of the final products either of $Me_2S_2O_2$ hydrolysis or of Wackenroder's reaction can oxidise HI, it is inferred that the oxidation is due to $H_2S_2O_2$ itself, *i.e.*, $H_2S_2O_2 + 2HI = 2H_2O + 2S + 2I$, as is confirmed by analysis when the reaction takes place in 98% HCO_2H. The decomp. of $H_2S_2O_2$ is considered to be reversible, in which event the occurrence of this substance as an intermediate product in Wackenroder's reaction is strongly supported by the above evidence. F. L. U.

Neutral tellurates and basic tellurates of nickel and cobalt. F. FOUASSON (Bull. Soc. chim., 1938, [v], **5**, 1380—1385; cf. A., 1938, I, 266).—Ppts. having $M^{II}O : TeO_3$ (n) = 1—2 (M^{II} = Co, Ni) are obtained on mixing aq. $M^{II}SO_4$ and Na_2TeO_4. The basic tellurates ($n = 2$) are obtained by using excess of $M^{II}SO_4$ or in slightly acid solution, and the neutral salts ($n = 1$) with excess of Na_2TeO_4 in strongly alkaline solution. The Te is not completely pptd. The ppts. are gelatinous and give vitreous masses when dried over H_2SO_4 A. J. E. W.

Molybdates, tungstates, and vanadates of some chromium complexes. E. NEUSSER (Z. anorg. Chem., 1938, **239**, 240—244).—The following *compounds* are described: $[Cr(NH_3)_6](MoO_4)Cl$; $[Cr(NH_3)_6](WO_4)Cl$; $[Cr(NH_3)_6](MoO_4)Br,3H_2O$; $[Cr(NH_3)_6](WO_4)Br,3H_2O$; $[Cr(NH_3)_6](MoO_4)I$ (impure); $[Cr(NH_3)_6]_2(WO_4)_2,W_2O_7,6H_2O$ (impure); $[Cr(NH_3)_6](VO_3)_3,3H_2O$; $[Cr(NH_3)_5Cl]Mo_3O_{10},5H_2O$; $[Cr(NH_3)_5Cl]WO_4$; $[Cr(NH_3)_5Cl](VO_3)_2$ (impure); $[Cr(NH_3)_5(CNS)]Mo_3O_{10},(NH_4)_2MoO_4,4H_2O$. F. J. G.

Reaction of neutralisation in sulphuric acid as a solvent. M. USSANOVITSCH (Acta Physicochim. U.R.S.S., 1937, **7**, 467—468).—In H_2SO_4, $HClO_4$ is neutralised thus: $NaHSO_4 + HClO_4 = NaClO_4 + H_2SO_4$; $H_3O{\cdot}HSO_4 + HClO_4 = H_3O{\cdot}ClO_4 + H_2SO_4$. W. R. A.

Iodous sulphates. I. MASSON and C. ARGUMENT (J.C.S., 1938, 1702—1708).—Decomp. of HIO_3 by conc. H_2SO_4 yields I_2O_3,SO_3 (I); no evidence of the alleged $I_2O_3,SO_3,0{\cdot}5H_2O$ (Chrétien, A., 1897, ii, 138) was obtained. The reaction occurring in the cold may be represented by $2I_2 + 3I_2O_5 \rightarrow 5I_2O_3$. In $H_2S_2O_7$ at 215—220° the reaction $I_2O_5 \rightarrow I_2O_3 + O_2$ occurs quantitatively. In acid more dil. than H_2SO_4,H_2O, (I) decomposes into HIO_3 and I; in $H_2S_2O_7$ it is converted into $I_2O_3,4SO_3,xH_2O$ (II) ($x = 1$, probably). When (II) is diluted to <100% H_2SO_4, (I) is formed, but I and I_2O_5 are pptd. as an intermediate step. The mechanism is discussed; it is concluded that solutions of (II) contain I^{III} in a complex ion (possibly negative) and that solutions of (I) contain the cations of an equilibrium $IO^+ + 2H^+ \rightleftharpoons I^{+++} + H_2O$. E. S. H.

Reaction between potassium permanganate and oxalic acid, and the decomposition of potassium manganioxalate. J. BRADLEY and G. VAN PRAAGH (J.C.S., 1938, 1624—1636).—The yellow solution formed by mixing aq. $KMnO_4$ and $H_2C_2O_4$ contains $[Mn^{III}(C_2O_4)_2,2H_2O]'$ (I), which decomposes slowly into MnC_2O_4 and CO_2. The pptn. of MnO_2 from $KMnO_4$ and $MnSO_4$, the conversion of MnO_2 into (I) by $H_2C_2O_4$, and the self-reduction of (I) have been studied. The reduction of MnO_2 by $H_2C_2O_4$ is a surface reaction, accompanied by a homogeneous reaction between $Mn^{\cdot\cdot}$ and $Mn^{\cdot\cdot\cdot\cdot}$, yielding $Mn^{\cdot\cdot\cdot}$. The initial rates of decomp. of (I) in media of different $[H^+]$ and $[H_2C_2O_4]$ have been measured, and the mechanism of decomp. is discussed. E. S. H.

Low-temperature oxidation of iron. H. R NELSON (J. Chem. Physics, 1938, **6**, 606—611; cf. A., 1937, I, 288).—Electron diffraction investigation of the oxide films formed on abraded Fe specimens by heating in air at 80—260° has not revealed structural effects due to a crit. temp. near 200°. α-Fe_2O_3 has been found on specimens oxidised at any temp. > 130°, provided that the period of oxidation is > a min. val. dependent on the temp. Lower oxidation temp. or shorter times strengthen the diffraction pattern due to the primary oxide film (γ-Fe_2O_3 or Fe_3O_4), which is detectable immediately after the abrasive treatment. This strengthening, however, is not accompanied by appreciable grain growth, and traces of Fe can be observed in the diffraction patterns after long oxidation periods at <120°. The thickness of the primary oxide film is estimated as >200 A. over some parts of the Fe surface. At temp. >193°, a new α-Fe_2O_3, probably formed by the outward diffusion of Fe through the oxide layer, is formed; this is more coarsely cryst. than, and has a different type of preferred orientation from, the α-Fe_2O_3 film which is formed first. The axis of preferred orientation of the α-Fe_2O_3 film, which is always symmetrical about the normal to the surface, cannot be attributed to pseudomorphism of the oxide crystals on the underlying Fe as is true for the primary oxide. W. R. A.

Ageing and properties of precipitates. XXIII. Post-precipitation of ferrous sulphide with cupric sulphide. I. M. KOLTHOFF and F. S. GRIFFITH (J. Amer. Chem. Soc., 1938, **60**, 2036—2039).—FeS is slowly post-pptd. with CuS from acid

solutions and rapidly at 70—95°; the mixed ppt. contains $CuFeS_2$. The amount of FeS increases with increasing [Fe"] and [CuS], and with decreasing [H']. The promoting effect of CuS decreases rapidly on ageing at 90°. The solubility of freshly pptd. FeS, expressed by the ratio $[Fe"]/[H']^2$, in solutions saturated with H_2S is 9×10^4 at room temp.; that of aged ppts. is $3—5 \times 10^4$. E. S. H.

Amorphous and crystallised oxide-hydrates and oxides. XLVI. Extraordinary reactivity of the ferric hydroxides. A. KRAUSE and A. LEWANDOWSKI (Z. anorg. Chem., 1938, **239**, 305—316).—The reactivities towards Ag_2O (with the formation of cryst. Ag ferrite) of various types of hydrated Fe_2O_3 have been studied at 20°, both in presence of H_2O and with air-dried material. The amorphous varieties, and especially the ordinary "ortho-hydroxide" (I), are the most reactive, but γ-FeO·OH (II) also reacts slowly. In presence of NaOH the reactions are much accelerated, but now (I) reacts at first less rapidly than "polyorthohydroxide," whilst (II) reacts even more rapidly than some of the amorphous varieties. At the b.p. the reaction is so rapid that these differences disappear. The reaction is to be regarded as a solid reaction, depending on the presence of "active" H atoms in OH groups. There is a correlation between the reactivity towards Ag_2O and the catalytic activity for the decomp. of H_2O_2. F. J. G.

Standardisation of volumetric solutions. S. H. WILSON (J. New Zealand Inst. Chem., 1938, **3**, 54—63).—A review dealing with the selection of primary and secondary standards and the prep. and methods of standardisation of aq. acids, alkalis, I, $Na_2S_2O_3$, and $KMnO_4$. $Na_2C_2O_4$ can be used as a primary standard for all these solutions. A. J. E. W.

Use of the glass electrode to evaluate quinhydrone electrode errors in examination of canned foods.—See B., 1938, 1359.

Use of sodium sulphoalizarinate as an indicator. R. WERNICKE and E. G. DANKERT (Anal. Asoc. Quím. Argentina, 1938, **26**, 48—50).—The p_H of the end-point given by Na sulphoalizarinate (alizarin-red S) varies with the salinity of the solution. F. R. G.

Mercurimetric determination of small amounts of chloride. S. M. DRATSCHEV and F. I. GINZBURG (J. Appl. Chem. Russ., 1938, **11**, 879—882).—Votoček's method (A., 1918, ii, 238) gives accurate results for solutions containing $\leq 0{\cdot}5$ p.p.m. of Cl'. The method is recommended for H_2O analysis. R. T.

Determination of iodine in chloroiodohydroxyquinoline, Vioform, and in colloidal silver iodide, Neoprotosil. Application of titrimetry to the methods of Carius and of Baubigny and Chavanne. C. STAINIER and L. LECLERCQ (Bull. Acad. roy. Med. Belg., 1936, [vi], **1**, 348—354; Chem. Zentr., 1937, i, 661).—The titrimetric method (reduction of AgI with $Zn-H_2SO_4$) is recommended. The colloidal AgI contains AgI 19·6, Cl 0·85, and other I 0·86%. A. H. C.

Electrometric determination of iodates with thiosulphate. P. SPACU (Bul. Soc. Ştiinţe Cluj, 1936, **8**, 399—404; Chem. Zentr., 1937, i, 136).—I produced in the reaction $HIO_3 + 5HI \rightarrow 3I_2 + 3H_2O$ is titrated against $Na_2S_2O_3$ and the end-point determined by the potential change using a $HgCl_2$ electrode and a Pt wire as indicator electrode. A. H. C.

Determination of fluorine in baking powders.—See B., 1938, 1353.

Determination of oxygen and available hydrogen in fuels.—See B., 1938, 1252.

Absorption and determination of atmospheric ozone by cooled silica gel. E. BRINER (Helv. Chim. Acta, 1938, **21**, 1218—1221).—Air is purified by KOH and passed successively through two empty tubes and over SiO_2 gel and active C cooled to −75° to −65° by EtOH–solid CO_2. The gel does not liberate O_3 when allowed to attain room temp. or shaken with H_2O but liberates I from aq. KI. This when titrated with 0·01N-$Na_2S_2O_3$ shows a concn. of $0{\cdot}8 \times 10^{-8}$ in the atm. Indications of the presence of O_3 in active C are not obtained. H. W.

Determination of total sulphur in liquid fuels.—See B., 1938, 1256.

Colorimetric determination of selenium in sulphur.—See B., 1938, 1293.

Kjeldahl nitrogen determination by the Parnas–Wagner modification. J. K. PARNAS (Z. anal. Chem., 1938, **114**, 261—275).—A macro-apparatus constructed on the lines of the well-known micro-apparatus is described. The steam distillation of macro-quantities of NH_3 is complete in 4·5 min. Details of both types of apparatus and procedure are given. Advantages of the method lie in the quick distillation of the NH_3, elimination of the possibility of its loss, the automatic emptying of the distillation flask, and the ease with which successive distillations can be made. L. S. T.

Kjeldahl nitrogen determination with Parnas' apparatus. R. FRESENIUS (Z. anal. Chem., 1938, **114**, 275—278).—Parnas' apparatus and procedure (cf. preceding abstract) have been tested and found satisfactory. Distillation of the considerable amount of NH_3 is complete in 4·5 min. The mixed indicator, Me-red + methylene-blue, was used in the titration. L. S. T.

Reactions in concentrated sulphuric acid. XI. Modifications of the Kjeldahl method. J. MILBAUER (Chem. Obzor, 1938, **13**, 25—28).—All known modifications of the Kjeldahl method are compared at a const. temp. by the times required for complete oxidation without mixing and with mixing by a stream of air. A method previously described (*ibid.*, 1936, 210) using the combination Hg : Se = 4 : 1, in the form $HgSO_4$ and SeO_2, is the most efficient. The H_2SO_4 is saturated with respect to the $HgSO_4$ and also contains 20 g. of P_2O_5 for each 50 ml. of H_2SO_4. This reagent reduces the time to 0·8% that required by the Kjeldahl method. Mixing by air in general reduces the time. F. R.

Determination of protein-ammonia in sewage. —See B., 1938, 1370.

Test for hydroxylamine and hyponitrous acid. G. GOPALA RAO and W. V. B. SANDARA RAO (Analyst, 1938, **63**, 718).—NH_2OH and $(HNO)_2$ react with resorcinol and KIO_3 at p_H 2 to give a stable cherry-red colour; 1 p.p.m. may be so detected. It is essential to conform to this p_H. Borates and HCO_3' do not interfere except in so far as they may alter the p_H. E. C. S.

Photometric micro-determination of phosphorus, chromium, and aluminium in steel.—See B., 1938, 1307.

Conductometric determination of soluble orthophosphates. A. CHRÉTIEN and J. KRAFT (Bull. Soc. chim., 1938, [v], **5**, 1399—1404; cf. A., 1938, I, 367).—100 ml. of the monacid phosphate solution (10—140 mg. PO_4), containing 0·5 ml. of 5% aq. NaCl, is titrated conductometrically with aq. $UO_2(OAc)_2$ (I) (30—35 g. per l.); a sharp break in the resistance curve shows complete pptn. of $M^IUO_2PO_4$. The (I) solution is standardised with aq. Na_2HPO_4 in which PO_4 is determined gravimetrically. Diacid phosphates are similarly determined after addition of 0·5—1 ml. of 5% aq. NaOAc. Accuracy to within 0·3% is claimed. A. J. E. W.

Alkalimetry of ammonium magnesium phosphate and arsenate. I. BELLUCCI and R. CORSINI (Annali Chim. Appl., 1938, **28**, 325—330).—The accuracy of the method of determining AsO_4''' or PO_4''' by pptn. as Mg NH_4 salt, treating the ppt. with excess of 0·1N-HCl, and back-titration with 0·1N-NaOH to Me-orange, is confirmed (cf. Donatelli, A., 1938, I, 415). F. O. H.

Methods using radioactive indicators. Solubility of ammonium phosphomolybdate and Woy's method [of determining phosphate as phosphomolybdate]. F. FERLA (Annali Chim. Appl., 1938, **28**, 331—336).—The use of ^{32}P allows accurate determination of the solubility of NH_4 phosphomolybdate in various concns. of HNO_3 and MoO_3 and hence greater accuracy in Woy's method. F. O. H.

Micro-determination of arsenic. J. P. L. VILLAMIL (Arch. Med. Legal, 1933, **6**, 349—357).—2 μg. of As can be detected with $AgNO_3$. S. O.

Determination of arsenic and antimony in hard lead.—See B., 1938, 1308.

Ferroin as redox indicator in the bromate determination of arsenite. L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, **114**, 116—119).—The acid AsO_3''' solution, containing $HgSO_4$ to prevent liberation of Br from the Br′ formed, is titrated with 0·1N-$KBrO_3$ in presence of ferroin as indicator and 2 drops of 0·01M-OsO_4 solution. The aq. $KBrO_3$ contains a small amount of $NaVO_3$, which acts as an inductor in the reaction between the indicator and the BrO_3'. Agreement with the potentiometric end-point is satisfactory. L. S. T.

Rubrophen as redox indicator in the bromometric determination of arsenite. L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, **114**, 197—200).—The AsO_3''' solution is acidified with 15 c.c. of conc. HCl and diluted to 50 c.c. After cooling, 3 g. of KBr and 0·5 c.c. of 0·01% rubrophen (I) solution are added, and the solution is titrated slowly with 0·1N-$KBrO_3$ until the red colour begins to fade at 0·3—0·5 c.c. before the end-point. The titration is completed with a 20 to 30 sec. interval between the additions of the drops until the solution is colourless. Comparison with the potentiometric end-point shows the results to be slightly high (~0·05 c.c. for ~20 c.c. of 0·1N-$KBrO_3$). The indicator solution is prepared by dissolving 0·01 g. of (I) in 5 c.c. of 2N-NaOH, adding N-HCl until the violet colour turns to red, and diluting to 100 c.c. L. S. T.

Determination of boron in waters, brine, and salt.—See B., 1938, 1291.

Determination of insoluble silica (quartz) by Lunge and Millberg's method.—See B., 1938, 1293.

Analysis of silicon carbide.—See B., 1938, 1298.

Determination of carbon in iron.—See B., 1938, 1304.

Determination of carbon in chromium steels and ferrochromium.—See B., 1938, 1307.

Semi-automatic determination of carbon dioxide in the atmosphere and in combustion gases.—See B., 1938, 1293.

Micro-titration of very dilute silver salt solutions. M. ZÜRCHER and G. HOEPE (Helv. Chim. Acta, 1938, **21**, 1272—1276).—An apparatus for electrometric titration in drops enables accurate determinations of $<5 \times 10^{-9}$ g. of Ag to be made by direct titration with very dil. aq. KI. J. W. S.

Sensitivity of chemical reactions. I. Reactions of cations. Z. KARAOGLANOV (Z. anal. Chem., 1938, **114**, 81—115).—Sensitivities, determined by a standard procedure and expressed as μg. per 10 c.c., are recorded and discussed for many well-known reactions of the commoner cations of the usual analytical groups. Some of the most sensitive reactions occur between $Ag^{\cdot}$ and aq. tannin, NH_2OH, $NHPh{\cdot}NH_2$, or KI; $Pb^{\cdot\cdot}$ and aq. H_2S or $(NH_4)_2S$, or $(NH_4)_2CrO_4$; $Bi^{\cdot\cdot\cdot}$ and aq. H_2S or $(NH_4)_2S$; $Cu^{\cdot\cdot}$ and cupferron or KI; $Cd^{\cdot\cdot}$ and $K_4Fe(CN)_6$; $Au^{\cdot\cdot\cdot}$ and aq. NH_2OH; $Al^{\cdot\cdot\cdot}$ and morin or alizarin S; $Cr^{\cdot\cdot\cdot}$ and $H_2O_2 + NaOH$; $Fe^{\cdot\cdot\cdot}$ and aq. H_2S or NH_4CNS; $Fe^{\cdot\cdot}$ and $K_3Fe(CN)_6$ or $(NH_4)_2S$, or dimethylglyoxime; $Ni^{\cdot\cdot}$ and aq. $(NH_4)_2S$, dimethylglyoxime, or NaOH + aq. Br; $Co^{\cdot\cdot}$ and $(NH_4)_2S$ or $K_4Fe(CN)_6$; $Mn^{\cdot\cdot}$ and KOH or KOH + aq. Br; $Zn^{\cdot\cdot}$ and $K_4Fe(CN)_6$ or resorcinol; $Ca^{\cdot\cdot}$ and $(NH_4)_2C_2O_4$; $Ba^{\cdot\cdot}$ and H_2SO_4 or Na_2SO_4. No sharp distinction can be made between colour and pptn. reactions as regards sensitivity. The colloidal state plays an important part in determining the sensitivity of a reaction, which, in general, is less when conditions favour the formation of relatively large amounts of sparingly sol. compounds. Chemical reactions show a wide variation in sensitivity, and, on the whole, colour reactions are the most sensitive independently of whether the colour depends on the formation of true or colloidal solutions.

The relationship between the solubility of a reaction product and the sensitivity of a reaction, and other factors on which sensitivity depends, are discussed. L. S. T.

Organic precipitants in quantitative analysis. M. G. RÆDER (Tids. Kjemi, 1938, **18**, 131—136).—A review. M. H. M. A.

Iowa system of qualitative analysis without hydrogen sulphide. J. CORNOG (J. Chem. Educ., 1938, **15**, 420—424).—The groups are $Pb^{\cdot\cdot}$, $Ag^{\cdot}$, and $Hg^{\cdot}$ (reagent, HCl); $Pb^{\cdot\cdot}$, $Ba^{\cdot\cdot}$, and $Ca^{\cdot\cdot}$ (H_2SO_4 + EtOH); $Hg^{\cdot\cdot}$, $Bi^{\cdot\cdot\cdot}$, $Fe^{\cdot\cdot}$, $Cu^{\cdot\cdot}$, $Co^{\cdot\cdot}$, $Ni^{\cdot\cdot}$, $Cd^{\cdot\cdot}$, $Zn^{\cdot\cdot}$, $As^{\cdot\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$, $Sn^{\cdot\cdot}$ [$(NH_4)_2S$ in acetate–AcOH buffered solution]; $Mn^{\cdot\cdot}$, $Mg^{\cdot\cdot}$, $Al^{\cdot\cdot\cdot}$, and $Cr^{\cdot\cdot}$ [$(NH_4)_3PO_4$ in alkaline solution]; $NH_4^{\cdot}$, $K^{\cdot}$, and $Na^{\cdot}$. Separations in these groups are outlined. L. S. T.

Colorimetric determination of small amounts of lead and zinc in soils and plants.—See B., 1938, 1342.

Determination of lead in baking powders.—See B., 1938, 1353.

Step-photometric determination with dithizone of lead, copper, and zinc in waters and foods.—See B., 1938, 1371.

Determination of copper and manganese in paper.—See B., 1938, 1278.

Determination of mercuric chloride in sublimate pastilles.—See B., 1938, 1293.

Inorganic chromatography. III. G. M. SCHWAB and G. DATTLER (Angew. Chem., 1938, **51**, 709—711; cf. A., 1937, I, 529).—The length of zones of Al_2O_3 (prep. described) occupied by bivalent cations depends on the tenacy of adsorption of the anion, which is simultaneously adsorbed. The adsorption of univalent cations is independent of that of the anion, which is not simultaneously adsorbed. It is best to use sulphates when comparing the behaviour of anions. In some cases the length of zone occupied depends solely on the no., and not the valency, of the atoms. Often the lengths occupied by ions adsorbed from a mixture ∝ the amounts of each present in solution, but there are exceptions, *e.g.*, ammines, and each case must be individually examined. R. S. C.

Determination of aluminium in iron and steel.—See B., 1938, 1304.

Determination of manganese as $MnSO_4,H_2O$. G. BRINKMANN and W. SCHMEDDING (Z. anal. Chem., 1938, **114**, 161—170).—The increase in wt. of anhyd. $MnSO_4$ (I) in air is due to the formation of $MnSO_4,H_2O$ (II). At room temp. the change is complete in 10—15 hr., after which no further increase in wt. occurs in air of normal humidity. Reconversion into (I) occurs slowly at 130°, but is complete in 3—4 hr. at 200°. (II) is obtained when $MnSO_4,4H_2O$ is heated at 105°. In a desiccator over conc. H_2SO_4 (ρ 1·84) (I) slowly increases in wt., but (II) remains unaltered. Both remain unchanged in wt. over freshly-dehydrated $CaCl_2$; (II) can be kept satisfactorily before weighing in an empty desiccator. (II) is preferable to (I) as the weighing form in the determination of Mn as sulphate. The solution containing Mn as the only cation is evaporated to dryness with conc. H_2SO_4, the residue is heated to 250° and finally at 500° for 20—30 min., moistened with a little H_2O, evaporated to dryness again, and heated to const. wt. at 110° (30 min.). (I) is a powerful desiccant. A procedure for determining Cd as anhyd. $CdSO_4$ is outlined. L. S. T.

Determination of minute quantities of manganese in waters rich in chloride and silica.—See B., 1938, 1371.

Organic reagents in analytical chemistry. J. V. DUBSKÝ and A. LANGER (Chem. Obzor, 1938, **13**, 49—50 78—80, 99—100, 123—124, 144—147).—A detailed description of the colour reactions of Fe^{II} salts with 20 org. reagents, and of Fe^{III} salts with 40 org. reagents, is given. Conditions and sensitivity of reactions are given. Fe^{II} salts react with a group containing enolisable H such as ·CO·C:N·OH in an open chain, whereas the combination of an alcoholic group with an oxime, which is sp. for $Cu^{\cdot\cdot}$, does not react with $Fe^{\cdot\cdot}$. F. R.

Bromatometric determination of ferrous iron. L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, **114**, 249—252).—The Fe^{II} compound is dissolved in N-H_2SO_4, the solution diluted to 40 c.c., and 10 c.c. of 25% H_3PO_4, 3g. of NaBr, and 1 c.c. of 0·1% $AuCl_3$ are added. The solution is titrated at 60—70° with 0·1N-$KBrO_3$ to an end-point corresponding with a comparison solution obtained by dissolving 3 g. of NaBr, 10 c.c. of 25% H_3PO_4, and 1 c.c. of 0·1% $AuCl_3$ in 40 c.c. of H_2O. L. S. T.

Separation of iron from cobalt, nickel, zinc, and manganese. A. KRÜGER (Z. anal. Chem., 1938, **114**, 241—248).—Chlorides and nitrates are converted into sulphates by evaporation with the calc. amount of H_2SO_4; the residue is dissolved in a little H_2O and treated at 40° with $(NH_4)_2CO_3$ until a permanent turbidity is obtained. After clearing the solution with acid, it is diluted with H_2O and heated just to boiling to ppt. most of the Fe as a mixture of basic sulphates. The Fe remaining in the filtered solution is pptd. by adding $(NH_4)_2CO_3$ and NH_4OAc solution and heating to boiling. Fe can be separated completely by this method from its mixtures with Zn, Ni, Co, or Mn. L. S. T.

Thiocyanate reaction for ferric ions in presence of iodine.—See B., 1938, 1361.

Simultaneous determination of cobalt and nickel. G. SPACU and C. G. MACAROVICI (Bul. Soc. Ştiinţe Cluj, 1936, **8**, 444—449; Chem. Zentr., 1937, i, 138).—Ni is determined as dimethylglyoxime compound or pptd. as $Ni(OH)_2$ and weighed as $[Ni(C_5H_5N)_4(SCN)_2]$ (I); Co and Ni are pptd. together from another sample as (I) and $[Co(C_5H_5N)_4(SCN)_2]$. A. H. C.

Chromium compound of 8-hydroxyquinoline. E. TAYLOR-AUSTIN (Analyst, 1938, **63**, 710—712).—In presence of NH_4OAc or NaOH, Cr is approx. quantitatively pptd. as $(C_9H_6ON)_3Cr$, but in presence of AcOH or HCl the amount pptd. ∝ the amount of Al present and is at a max. when Cr : Al = 1. The conditions for obtaining the max. yield (99%) of $(C_9H_6ON)_3Cr$ are specified. E. C. S.

Rapid determination of molybdenum in steels.—See B., 1938, 1307.

Iodometric determination of tin in presence of antimony. M. HEGEDÜS (Z. anal. Chem., 1938, **114**, 200—208).—Errors arising in this determination owing to the presence of Sb are discussed, and a modification of the method described previously (A., 1938, I, 46) has been designed to minimise them. Zn + Pb (in presence of Na_2SO_4) are used as the reducing agents in the procedure described. The error increases linearly with an increase in the ratio Sb : Sn, and a correction can be applied. When this ratio is $>3:1$ the method is trustworthy. For small amounts of Sn in presence of much Sb, the prior addition of a known amount of pure Sn is recommended. L. S. T.

Effect of arsenic, vanadium, iron, and tin on the determination of antimony in high-lead mixtures by a modified permanganate method. R. G. MYERS (Philippine J. Sci., 1938, **66**, 75—92).—Details of a method for this determination are given, and data showing the effects of As, V, Fe, and their mixtures ($>1\%$) with Sn, on the method are recorded. The method has been tested for 0·5—25% of Sb and 75·5—98·8% of Pb. 1 c.c. of 0·1N-$KMnO_4$ (oxalate) at 30° is found to be equiv. to 5·92 mg. of Sb when standardised against Sb alone and to 5·886 mg. when standardised against Sb in presence of Pb. Possible losses of Sb from boiling HCl solutions favour a [HCl] of 9·5%. The effect of As on the determination of Sb is to give high results, and a correction is necessary. V gives, in general, low results, but the effect is too variable to permit a correction to be applied. Fe leads to low results but can be corr. for, and offsets the positive error due to As. Sn may tend to reduce the negative effect of Fe and V. Bi, Cu, Cd, and Zn in small amounts probably have no adverse effects on this method. L. S. T.

Relative value of certain azo-derivatives of 8-hydroxyquinoline as analytical reagents. T. BOYD, E. F. DEGERING, and R. N. SHREVE (Ind. Eng. Chem. [Anal], 1938, **10**, 606—608).—The work of Gutzeit and Monnier (A., 1933, 732) has been extended and tables showing the reactions of 18 azo-derivatives of 8-hydroxyquinoline are given. The following derivatives give sp. tests for the metals indicated: 5-(2′-hydroxybenzeneazo)-, $Pd^{\cdot\cdot}$; 5-(3′-hydroxybenzeneazo)-, $Hg^{\cdot\cdot}$, $Pd^{\cdot\cdot}$; 5-(2′-chlorobenzeneazo)-, $Pd^{\cdot\cdot}$; 5-(3′-chlorobenzeneazo)-, $Hg^{\cdot\cdot}$, $Pd^{\cdot\cdot}$; 5-(4′-chlorobenzeneazo)-, $Hg^{\cdot\cdot}$; 5-(3′-tolueneazo)-, $Hg^{\cdot\cdot}$, Pd; 5-(4′-arsinobenzineazo)-, $Hg^{\cdot\cdot}$; 5-(3′-6′-disulpho-8′-hydroxy-α-naphthaleneazo)-, $Hg^{\cdot\cdot}$, and 5-(benzidine-monoazo)-8-hydroxyquinoline, $Pd^{\cdot\cdot}$, $VO_2^{\cdot}$, or VO_3'. In practically all cases Cl′ obscures the test but the tartrate ion has no effect. F. N. W.

Steam drying oven. D. L. RANDALL (J. Chem. Educ., 1938, **15**, 470).—A double-walled laboratory oven, giving temp. between 100° and 105°, is described. L. S. T.

Lag in the indication of thermometers. II. F. LIENEWEG (Wiss. Veröff. Siemens-Werken, 1938, **17**, 19—32; cf. A., 1938, I, 99).—The lag in the indication of thermometers subjected to periodic temp. changes, or when placed in media of which the temp. varies linearly with time, has been investigated. A. J. M.

Photometry of coloured light sources. W. E. FORSYTHE, B. T. BARNES, and A. L. SCHRIDER (J. Opt. Soc. Amer., 1938, **28**, 241—248).—Results of measurements of the light output of highly coloured light sources are described. The direct comparison photometer with a coloured filter between the comparison source and the photometer has been used. The filter is selected to eliminate as nearly as possible the colour difference between the W comparison lamp and the source under examination. T. H. G.

Polarisation-microscopical experiments with Bravais' double plates of Cellophane. H. H. PFEIFFER (Kolloid-Z., 1938, **85**, 49—52).—The use of Cellophane plates in place of a Nicol prism for work at temp. $<0°$ is described. E. S. H.

Technique of Röntgen spectral analysis. P. BRAUER (Z. tech. Physik, 1938, **19**, 232—235).—Electrostatic shielding of the anticathode allows of rapid and exact analysis of sensitive powders. O. D. S.

String suspended and thermostated Littrow spectrograph. N. A. KENT and R. G. LACOUNT (J. Opt. Soc. Amer., 1938, **28**, 266—268).—A method of mounting a very large instrument, whereby mechanical vibration and variation of temp. have both been satisfactorily overcome, is described. T. H. G.

Apparatus for Raman spectroscopy at low temperatures. G. GLOCKLER and M. M. RENFREW (Rev. Sci. Instr., 1938, **9**, 306—308).—Apparatus consisting of a horizontal Raman tube cooled with a current of air, suitable for use at 0° to −180°, is fully described. A. J. E. W.

Filters for the study of Raman spectra of liquids and powders. F. J. TABOURY (Bull. Soc. chim., 1938, [v], **5**, 1394—1399).—The prep. from readily available materials of filters transparent to the following Hg radiations is described: 4046 (3650, 4358); 4358 (3650—4046, 4916); 4358—6000 (4358); 4046, 4358 (3650 A.). The λλ in parentheses are absorbed. The filters are designed for use with Ananthakrishnan's double-filter method (A., 1936, 1480). The exposure coeffs. are $>1·6$ A. J. E. W.

Apparatus for the study of the Raman effect. A. H. PFUND (J. Opt. Soc. Amer., 1938, **28**, 264—265).—The bulb of a motor-car head-lamp is replaced in the reflector by a Hg lamp (cf. Physical Rev., 1914, **3**, 314). The reflector (concave downwards) rests on three wooden blocks on a sheet of Pyrex glass which is similarly separated from a sheet of ordinary glass. The cooling thus obtained prevents the liquid in the Raman tube from boiling. The latter is inserted vertically in a second reflector, coaxial with the first but concave upwards, which is fixed in an ordinary tripod. The lower end of the Raman tube is closed by a totally reflecting prism through which the light passes to a spectrograph. T. H. G.

Use of infra-red absorption spectra in chemical analysis. J. LECOMTE (Mem. Soc. Ing. Civ. France,

1938, **91**, 135—163).—Experimental technique is described, and applications of the method are illustrated by a discussion of the transmission curves for certain saturated aliphatic hydrocarbons, alcohols, xylenes, and org. mixtures such as essences and oils. L. S. T.

Interval recorder for analysis of spectra. G. R. HARRISON (J. Opt. Soc. Amer., 1938, **28**, 290—292).—A device which automatically selects pairs of lines having a const. wave no. difference and records their wave nos. on a film is described. F. J. L.

Photo-electric "colorimeters." P. E. KLOPSTEG (Science, 1938, **88**, 336).—Difficulties alleged to be encountered in the use of a single photo-cell in a photo-electric colorimeter (A., 1938, I, 537) are obviated in the Sheard–Sanford photolometer. L. S. T.

Experimental determination of the optical constants of metals. Methods and results. J. B. NATHANSON (J. Opt. Soc. Amer., 1938, **28**, 300—310).—A lecture.

Determination of optical constants with the aid of an optical pyrometer. A. G. WORTHING (J. Opt. Soc. Amer., 1938, **28**, 311—312).—The advantages of using an optical pyrometer for determining the absorption index of metals are discussed. F. J. L.

Diffraction by irregular gratings. R. W. DITCHBURN (Proc. Roy. Irish Acad., 1938, **44**, A, 123—138).—The properties of an echelon grating in which the thickness of any plate is a small multiple of one fundamental thickness and of a plane grating of irregular spacing are discussed. With some gratings of this type it is possible to obtain a ratio of resolving power to lines ruled which is considerably > the corresponding ratio for equal space gratings. The higher resolving power need not involve the production of large secondary max. F. J. L.

Measurements of the reflecting powers [of surfaces] by means of the microscope. L. CAPDECOMME (Bull. Soc. franç. Min., 1938, **61**, 5—118).—A detailed investigation of photometric methods for the examination of the reflecting powers of small surfaces. L. S. T.

Automatic intensity and integrated intensity recorder for photon counters. M. KATO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 981—990).—The construction, calibration, and application of an apparatus, by which intensity at any instant and integrated intensity over any period are automatically calc. and recorded directly on a sheet of paper, are described. N. M. B.

Process for producing intense *X*-ray flashes. M. STEENBECK (Wiss. Veröff. Siemens-Werken, 1938, **17**, 1—18).—An apparatus for producing intense *X*-ray flashes of short duration is described. The momentary intensity is 10^3—10^4 times that of the best high-vac. *X*-ray tube, and the apparatus differs from that of Kingdon and Tanis (A., 1938, I, 123) in the small size of the *X*-ray focal spot and the consequent possibility of obtaining very sharp *X*-ray photographs. A. J. M.

Standard battery. G. A. HULETT (J. Physical Chem., 1938, **42**, 972—974; cf. A., 1933, 572).—Improvements of technique in preparing a Weston cell standard battery are described. J. W. S.

Selection of laboratory rheostats. M. N. STATES (Canad. Chem., 1938, **22**, 489—490, 500).—The design characteristics of rheostats are discussed in relation to their uses. L. S. T.

Fluctuations in the counts of Geiger counters. R. L. DRISCOLL and A. E. RUARK (Physical Rev., 1937, [ii], **51**, 688).—An improved apparatus for recording automatically all counts and all intervals between successive counts > a fixed time has been constructed. L. S. T.

Influence of covering electrode materials on the sensitivity of selenium photo-cells. P. GÖRLICH and W. LANG (Z. physikal. Chem., 1938, **B**, **41**, 23—32).—Previous investigations (cf. A., 1937, I, 446) on the influence of various covering electrode materials on Se photo-cells are extended. The results indicate that through the intercalation of suitable "Störzentren" in the Se layer, increase of the photo-current may be obtained. With "Cd-Störstellen" such an increase has been demonstrated. W. R. A.

Cyclotron and its applications. J. CHADWICK (Nature, 1938, **142**, 630—634).—A lecture. L. S. T.

Projection electroscope for alpha- and beta-rays. B. A. SPICER (J. Sci. Instr., 1938, **15**, 336—338).—A Au-leaf electroscope in which an image of the leaf can be projected on to a screen is described. J. A. D.

Micro-Kjeldahl distillation apparatus. H. MARZETOWICZ (Mühlenlab., 1938, **8**, 141—142).—Loss of N is prevented by cooling the receiver, using a double-walled flask through which cold H_2O passes. E. A. F.

Method of gas analysis depending on the optic-acoustic phenomenon of Tyndall and Röntgen. M. VEINGEROV (Compt. rend. Acad. Sci. U.R.S.S., 1938, **19**, 687—688). F. J. L.

Volumetric analysis and precision. B. DURANTON (Ann. Chim. Analyt., 1938, [iii], **20**, 257—261).—The methods described permit the measurement of vols. with an accuracy approaching 1 in 10^5, and the standardisation of solutions with a precision of 1 in 10^4 without the use of accurately calibrated pipettes or burettes. L. S. T.

Steam-driven ultracentrifuge. L. G. HOXTON and J. W. BEAMS (Physical Rev., 1937, [ii], **51**, 690).—An ultracentrifuge similar to that described previously (Rev. Sci. Instr., 1935, **6**, 299) but driven by electrically-generated steam instead of air has been constructed. L. S. T.

Inverted ultracentrifuge. J. W. BEAMS and F. W. LINKE (Physical Rev., 1937, [ii], **51**, 689).—An air-driven, vac. type of ultracentrifuge, in which the large rotor extends upwards from the turbine instead of downwards as in the original design (Rev. Sci. Instr., 1935, **6**, 299; cf. A., 1936, 1312), is described. L. S. T.

Measurement of the surface tension of viscous liquids. C. A. BRADLEY, jun. (J. Amer. Ceram. Soc., 1938, **21**, 339—344).—Vals. of γ for a series of solutions of rosin in $CH_2Ph{\cdot}OBz$ (γ, 100—2500 poises at 25°) determined by the capillary rise and the max. bubble pressure methods were consistent within 1%. The latter method was then applied to a series of glasses at temp. up to 1500° (50—2500 poises) with an accuracy of 1%. A technique of measurement by the rapid approx. method of sessile drops is also described. J. A. S.

Manometer for use with corrosive gases. R. S. BRADLEY (J. Sci. Instr., 1938, **15**, 338).—The buoyancy change of a glass bulb suspended from the end of a quartz spiral spring indicates the pressure of corrosive gases up to 1 atm. J. A. D.

All-glass still for continuous production of water of analytical quality. I. C. P. SMITH (Chem. and Ind., 1938, 963—965).—Apparatus is described in which H_2O is condensed and collected close to its b.p. so that the gases removed do not re-dissolve. S. M.

Efficient vacuum fractionating columns. A. KLEM (Nature, 1938, **142**, 616).—Three types of vac. distillation apparatus suitable for distilling 5—500 g. of hydrocarbons, alcohols, and particularly esters, have been constructed. Effectiveness of fractionation is illustrated by data for the separation of a mixture of esters. L. S. T.

Apparatus for distilling with steam.—See B., 1938, 1245.

Fractionation of oxygen isotopes by distillation of water. A. E. BRODSKI, O. K. SKARRE, and V. A. ALEXANDROVITSCH (Acta Physicochim. U.R.S.S., 1937, **7**, 469—472).—The constructional details and performance of a distilling apparatus for the simultaneous enrichment of D and ^{18}O are given. W. R. A.

Drilling small holes in glass. N. G. HEATLEY (J. Sci. Instr., 1938, **15**, 340—341).—A review of methods. Particular attention is directed to the use of diamond-headed drills and other diamond mounts. J. A. D.

Ground joints with independent sleeves. G. VALENSI (Bull. Soc. chim., 1938, [v], **5**, 1415—1419).—The tubes to be joined carry concentric cones, connexion being made with a separate sleeve socket. The joints are suitable for use where the tubes cannot be rotated to distribute the lubricant in the usual type of joint. A. J. E. W.

Piston oils of low spreading pressure. A. NORRIS and T. W. J. TAYLOR (J.C.S., 1938, 1719—1720).—Oils of controllable spreading pressure, for transference of surface films from H_2O to a solid, are obtained by mixing Et myristate with medicinal paraffin in light petroleum and evaporating off the light petroleum. E. S. H.

Growing of large single crystals of potassium bromide. K. CHAMBERLAIN (Rev. Sci. Instr., 1938, **9**, 322—324).—The construction and use of an electric furnace for growing crystals by Kyropoulos and Korth's method (A., 1930, 1238; 1933, 1001) are described. A. J. E. W.

Pressure regulator for compressed-air lines. S. CHAPMAN and S. GORRILL (Rev. Sci. Instr., 1938, **9**, 330—331).—The construction and operation of a weighted-valve type regulator are described. The pressure (2—50 cm., gauge) is maintained const. within 1% for flow rates of >4 l. per sec. A. J. E. W.

Determination of the size and charge of individual particles. F. EHRENHAFT (Physikal. Z., 1938, **39**, 673—687).—A review of former work is given and new results of the direct microscopical determination of the size of small particles and the measurement of their charge are described. It is claimed that the method indicates the existence of charges $<$ that of the electron. A. J. M.

Precise measurement of g from the fall of bodies in a vacuum. A. GUILLET (Compt. rend., 1938, **207**, 614—616).—The accuracy and technique of falling-sphere methods are discussed. A. J. E. W.

Polystyrene as an insulator. H. C. POLLOCK and M. H. NICHOLS (Rev. Sci. Instr., 1938, **9**, 331).—Polystyrene is easily worked and has good mechanical properties. Its insulating properties are good at 30° and 75% R.H. A. J. E. W.

Historical studies on the phlogiston theory. III. Light and heat in combustion. J. R. PARTINGTON and D. MCKIE (Ann. Sci., 1938, **3**, 337—371).

The radiant heat spectrum from Herschel to Melloni. II. The work of Melloni and his contemporaries. E. S. CORNELL (Ann. Sci., 1938, **3**, 402—416).

Discovery of the optical rotatory power of tartaric acid. T. S. PATTERSON (Ann. Sci., 1938, **3**, 431—434).

Count Michael Maier's use of the symbolism of alchemy. T. L. DAVIS (J. Chem. Educ., 1938, **15**, 403—410).—Several alchemical drawings are reproduced and discussed. L. S. T.

Geochemistry.

Concentration and measurement of atmospheric ozone. (A) W. C. REYNOLDS. (B) F. A. PANETH and J. L. EDGAR (Nature, 1938, **142**, 571).—(A) The results of Paneth and Edgar (A., 1938, 1, 479) agree with those obtained previously by the author (J.S.C.I., 1930, **49**, 168T). NO_2 is not a normal constituent of country air.

(B) Chemical methods previously used for the determination of O_3 in air are discussed critically. L. S. T.

Copper content of sea-water. K. KALLE and H. WATTENBERG (Naturwiss., 1938, **26**, 630—631).—The Cu content of the H_2O of the Sargasso sea (27° N., 80° W. to 32½° N., 64½° W.) was determined at 10

different stations by a photometric method in the "Meteor" expedition in the N. Atlantic during 1938. The concn. of Cu varied from <3 to 12 μg. per l. A series of experiments at greater depths gave concns. varying between 10 and 30 μg. per l., but may be vitiated by the presence of impurities. The colour of sea-H_2O is not affected by [Cu]. A. J. M.

Phosphate cycle in oceans. M. Steiner (Naturwiss., 1938, **26**, 723—724).—The org. P. of dead marine organisms must be very rapidly converted into the inorg. form, and again rapidly taken up by living organisms. This is due partly to bacterial decomp. of org. phosphates and partly to a post-mortem enzymic decomp. Results of experiments on the rate of production of inorg. P from plankton killed with PhMe at different temp. indicate that a very active characteristic phosphatase must be present. The amount of inorg. P present in liquids containing plankton and H_2O, Ca glycerophosphate, Cu fructose diphosphate, phytin, and Na nucleate, respectively, was determined. Simultaneously with the formation of inorg. P there is a migration of the enzyme from the body of the organism. A. J. M.

Radium and radon content of Pacific Ocean water, life, and sediments. R. D. Evans, A. F. Kip, and E. G. Moberg (Amer. J. Sci., 1938, [v], **36**, 241—259).—The results of approx. 50 Rn analyses made on 31 different samples of ocean H_2O, life, and sediments are recorded. The Ra content of the sea-H_2O is several orders of magnitude lower than that found by former investigators. The difference is due to the technique employed. 1600 c.c. of sea-H_2O contain $\sim10^{-13}$ g. of Ra and $<10^{-18}$ g. of Rn. At several stations the [Ra] increases largely with depth, indicating that Ra is being continuously pptd. from the ocean. The bottom mud in quiet deep H_2O shows a high Ra content, mainly due to the high radioactivity of the finest particles of the sediment. The Ra content of a few marine animals and plants is ~100 times that of the H_2O in which they live. L. S. T.

Analysis of thermal waters of San Lorenzo near Roccamena (Palermo). R. Indovina and P. L. Alliata (Annali Chim. Appl., 1938, **28**, 336—346).—Chemical and physico-chemical data are tabulated. F. O. H.

Subsoil waters of the Troitzki forest steppe (S. Ural). K. B. Shaggar (J. Appl. Chem. Russ., 1938, **11**, 754—758).—Analytical data are recorded. R. T.

Geologic structure and occurrence of gas in part of S.W. New York. I. Structure and gas possibilities of the Oriskany sandstone in Steuben, Yates, and parts of the adjacent counties. W. H. Bradley and J. F. Pepper (U.S. Geol. Survey, 1938, Bull. 899—A, 68 pp.). L. S. T.

Subsurface geology and oil and gas resources of Osage County, Oklahoma. I. N. W. Bass, L. E. Kennedy, W. R. Dillard, O. Leatherock, and J. H. Hengst (U.S. Geol. Survey, 1938, Bull. 900—A, 45 pp.).—Numerous oil- and gas-producing beds are described and their yields given. L. S. T.

Three meteoritic falls in the U.S.S.R. (A) L. S. Selivanov. (B) D. P. Maliuga. (C) E. L. Krinov (Nature, 1938, **142**, 623, 623, 624).—(A) The stony meteorites of (A) Kainsaz, (B) Kaptal-Aryk, and (C) Lavrentievka are described. All three can be referred to the chondrites. L. S. T.

Loss of nickel from meteorites through weathering. H. H. Nininger (Amer. Min., 1938, **23**, 536—537).—Data concerning the rate of removal of Ni from an oxidised meteorite by leaching with tap-H_2O are recorded. L. S. T.

Composition of the earth at a depth of 500 to 700 km. K. E. Bullen (Nature, 1938, **142**, 671—672).—Geophysical evidence indicates that a change in properties of the earth occurs at 500 to 700 km. below the surface. L. S. T.

Radon condensation method of determining geologic age. N. B. Keevil (Amer. J. Sci., 1938, [v], **36**, 304—309).—An improvement on the two well-known methods for determining the He age of rocks involves direct collection and condensation at −196° of the Rn liberated during fusion of the rock, the He and Th determinations being made in the usual way. A comparison of this method with the direct fusion, α-count method, and the indirect Rn, Th, and He method for determining the He age of Quincy granite is given. L. S. T.

Rock formation: nature's chemical industry. G. W. Morey (Chem. and Ind., 1938, 966—971).—Processes in nature by which many different types of igneous rock and minerals have been formed from a uniform, magmatic mass are outlined, and are correlated with well-known chemical processes. Fractional crystallisation with the separation of crystals from mother-liquor by settling under the influence of gravity or by a squeezing-out process akin to filtration is the chief factor concerned. Other effects are the separation of immiscible liquids, transport of material through a vapour phase, distillation, and sublimation. L. S. T.

Origin of "terra rossa." E. Blanck and R. Melville (Chem. Erde, 1938, **12**, 104—110).—Analyses are given of the portions sol. and insol. in HCl and in $H_2O + CO_2$ for a black marble and a white marble. The residues have not quite the composition of "terra rossa." (Cf. A., 1930, 732.) L. J. S.

Agalmatolite in Brazil. L. J. de Moraes and V. Leinz (Chem. Erde, 1938, **12**, 95—103).—Several large deposits of agalmatolite occur banded with schistose rocks near Pará de Minas. The material consists mainly of fine-scaled pyrophyllite with relics of kyanite, and it is supposed to have resulted by the pneumatolytic-hydrothermal alteration of bands of kyanite-schist: $Al_2O_3,SiO_2 + 3SiO_2 + H_2O = Al_2O_3,4SiO_2,H_2O$. L. J. S.

Formation of granite. D. Guimarães (Chem. Erde, 1938, **12**, 82—94).—The residual products in the crystallisation of a basic magma are rich in SiO_2, K, and volatiles. These may invade sedimentary and other rocks, producing granitisation. L. J. S.

Magmatic apatite. A. KIND (Chem. Erde, 1938, **12**, 50—81).—Chemical analysis of igneous rocks of seven different types (SiO_2 66·03—40·39, P_2O_5 0·18—1·23%) and of the apatite isolated from them are given. The apatite contains F 1·10—2·56, Cl 0·13—0·96, rare earths 0·77—4·21%, etc. Variations in n with interchange of OH–F, F–Cl, Ca–Na, Ca–Mn, Ca–Fe are plotted for apatite and some other minerals. In the rocks P_2O_5 and TiO_2 both increase with diminishing SiO_2. L. J. S.

Yeatmanite, a new mineral, and sarkinite from Franklin, New Jersey. C. PALACHE, L. H. BAUER, and H. BERMAN (Amer. Min., 1938, **23**, 527—530).—*Yeatmanite* (I), $(Mn,Zn)_{16}Sb_2Si_4O_{29}$, triclinic, pseudo-orthorhombic, $a_0 : b_0 : c_0 = 0·7811 : 1 : 0·4775$, α 103° 49′, β 101° 45′, γ 87° 12′, hardness 4, ρ 5·02±0·10, n_X 1·873, n_Y 1·905, n_Z 1·910 (all ±0·003) occurs as clove-brown cryst. plates embedded in willemite (II). The pink mineral with which (I) is associated in the (II) differs from Långban sarkinite only in having 5·38% of Zn. Chemical analyses of (I) and the pink mineral are recorded. L. S. T.

Axinite. M. A. PEACOCK (Amer. Min., 1938, **23**, 522—526).—Notes supplementary to a recent communication (A., 1937, I, 430). L. S. T.

Mineral fluorescence. E. S. C. SMITH and W. H. PARSONS (Amer. Min., 1938, **23**, 513—521).—The behaviour of 43 minerals in ultra-violet light from an instrument giving monochromatic radiant energy of a higher order of magnitude than hitherto possible is described. With the 9 minerals that undergo colour change, the λ of the fluorescent colour varies directly with the λ of the incident ultra-violet radiation. L. S. T.

Etch figures of quartz. W. L. BOND (Z. Krist., 1938, **99**, 488—498).—After etching, with HF, the ground outer surface of a hollow spherical segment of *D*-quartz, a photomicrographic survey shows the dependence of detail and of extent and nature of pattern on crystallographic orientation. I. McA.

Isotypy between scorodite $Fe[AsO_4|(H_2O)_2]$ and norbergite $Mg_3[SiO_4|(OH,F)_2]$. H. STRUNZ (Z. Krist., 1938, **99**, 513—514; cf. A., 1938, I, 235).—The rhombic cell of $FeAsO_4,2H_2O$ has a 8·88, b 10·26, c 9·98 A.; 8 mols. per cell; symmetry D_{2h}. Metrical and structural relations with norbergite are discussed in illustration of at. substitution in silicates. I. McA.

Barsowite. H. STRUNZ (Z. Krist., 1938, **99**, 515).—Two varieties of the mineral are distinguished optically, but chemical and *X*-ray analyses prove their identity with anorthite. I. McA.

Minerals from Manchoukuo. II. Morphological study of carbonate minerals. T. SUDO (Rept. Inst. Sci. Res. Manchoukuo, 1938, **2**, 245—272).—Data for calcites, cerusites, and dolomite from the Yokajoshi mine, and dolomite from Seisuiji, Daisekkyo, are recorded. L. S. T.

Tantalite occurring in a Korean gold placer. S. IIMORI and S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1010—1013).—The ρ, cryst. form, and composition of the specimens isolated are reported. N. M. B.

Abukumalite, a new yttrium mineral. S. HATA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1018—1023).—Abukumalite, $R^{II}R^{III}_2(Si,P)_2O_8$ (R^{II} = Ca; R^{III} = Y, Gd, Dy, Er, etc.), hexagonal, has $a : c = 1 : 0·7$ and $a_0 = 5·7$ A. Analysis: SiO_2 20·84, Fe_2O_3 2·10, MnO 1·13, Al_2O_3 1·05, CaO 13·53, MgO 0·22, Ce earths 6·45, Y earths 45·98, ThO_2 0·90, P_2O_5 5·84, H_2O- 0·16, H_2O+ 0·57, CO_2 0·08, F 0·45, total 99·30. N. M. B.

Columbite from Korea. S. HATA and T. IIMORI (Bull. Inst. Phys. Chem. Res. Tokyo, 1938, **17**, 642—643).—Analyses of columbite newly discovered in two localities are reported. N. M. B.

Pyrite with perfect octahedral separation. A. NEUHAUS (Chem. Erde, 1938, **12**, 23—41).—Grains of pyrite from granite near Freiberg, Saxony, show a perfect separation parallel to the octahedral faces, due to a fine lamellar intergrowth in parallel position of pyrite and blende, the lattice dimensions of which are very nearly the same. L. J. S.

Hornblendes and primary structures of the San Marcos gabbro. F. S. MILLER (Bull. Geol. Soc. Amer., 1938, **49**, 1213—1231).—Five types of hornblende are distinguished according to colour, habit, and occurrence. The pale green hornblende of the olivine (I) rocks and the deep green hornblende of the norites are the earliest types and were formed mainly by reaction with (I) and pyroxene. The coarse green-brown hornblende is predominantly primary. The pale fibrous and blue-green hornblendes are of hydrothermal origin. Optical properties are recorded. Three chemical analyses [F. A. GONYER] of primary igneous rocks are given. L. S. T.

Calcium carbonate content of some California Mesozoic and Tertiary sediments. P. D. TRASK (Bull. Geol. Soc. Amer., 1938, **49**, 1169—1181).—The $CaCO_3$ content of ~8500 outcrop and well samples of these sediments has been determined, mainly by a semi-quant. effervescence method. In general, the different formations have an average $CaCO_3$ content of ~5%, the Miocene sediments being the richest (~6%) and the Eocene sediments the poorest (~2%). Owing to the effect of leaching, the amount of $CaCO_3$ in outcrop samples is < in well samples of corresponding age. The areal distribution of $CaCO_3$ among sediments of similar age shows little relationship to the conditions of deposition. Dolomite is fairly common in the Jurassic and Cretaceous sediments, less common in the Eocene, Oligocene, and Miocene, and rare in the Pliocene sediments. L. S. T.

Meta-conglomerates in the gneisses of the Saxon Erzgebirge. K. R. MEHNERT (Tsch. Min. Petr. Mitt., 1938, **50**, 194—272).—Crushed and rolled-out conglomerates have given rise to gneisses. Descriptions with micrometric mineral analyses are given of the relic pebbles of various igneous and sedimentary rocks. A chemical analysis of a granite pebble is given. L. J. S.

Gypsum problem in the U.S.S.R. N. I. BUJALOV and A. J. ZVORIKIN (Ann. Sect. Anal. Physico-Chim., 1938, **11**, 327—336).—The distribution and origin of the gypsum deposits of W. Kazakstan are discussed. R. T.

Hydroxidic nickel and magnesium silicate minerals. K. SPANGENBERG (Naturwiss., 1938, **26**, 578—579).—In pimelite, $3(Ni,Mg)O,4SiO_2,H_2O + xH_2O$, the xH_2O is loosely bound. For the mineral containing most H_2O the greatest distance between the lattice planes is 12·8 A. and this val. falls to 9·6 A. for $x = 0·3$, without appreciable alteration of the optical consts. of the crystal, which are given. Garnierite, $3(Ni,Mg)O,2SiO_2,2H_2O$, gives an *X*-ray diagram analogous to that of chrysotile. The optical data for garnierite and schuchardtite are given. A. J. M.

Axinite. The reciprocal and the Bravais lattice. W. F. DE JONG (Z. Krist., 1938, **99**, 326—335; cf. A., 1938, I, 234, 299; Gossner, A., 1933, 116).—Performance of the completed rotating-film *X*-ray spectrometer and ancillary technique are shown in a determination of the elements of the reciprocal lattice and triclinic cell of $Ca_2MgHBAl_2(SiO_4)_4$. Cell elements (a 7·13, b 8·91, c 9·14 A., α 91° 51′, β 102° 52′, γ 81° 57′) confirm Gossner's vals. on reorientation. I. McA.

Synthesis of hydroboracite. A. V. NIKOLAIEV and N. M. SELIVANOVA (Compt. rend. Acad. Sci. U.R.S.S., 1938, **20**, 29—30).—The cryst. deposit from an aq. solution of $CaCl_2$, $MgCl_2,6H_2O$, and $Na_2B_4O_7,10H_2O$, after long keeping at 50°, is shown by optical, *X*-ray, and chemical analyses to be similar to the natural mineral. I. McA.

Turbid sylvite. J. D'ANS and R. KÜHN (Kali, 1938, **32**, 152—155).—Sylvite from Vienenburg owes its turbidity to inclusions of small crystals of rock-salt. The NaCl content is approx. 0·35% (optical estimate 0·25%). Chemical analysis gave no SO_4'', but microscopical examination revealed isolated, doubly-refracting particles, probably of anhydrite and kieserite. The distribution and orientation of the rock-salt crystals in the sylvite is shown by means of photomicrographs. Heating at 250° for 71 hr. increases the turbidity, owing to disintegration of the rock-salt crystals. The conditions under which these crystals have been embedded in the sylvite are discussed. L. S. T.

Melanophlogite. S. VON GLISZCZYNSKI and E. STOICOVICI (Z. Krist., 1938, **99**, 238—250).—Debye-Scherrer *X*-radiograms of the Sicilian mineral (hexagonal cell, a 4·907, c 5·396 A.) prove its identity with α-quartz. It is not homogeneous, the quartz grain orientation derived from a study of structure and optics suggesting genesis from a SiO_2 lattice of higher symmetry, cubic cristobalite. Physical properties of the SiO_2 forms are compared. I. McA.

Crystal structure of talc and pyrophyllite. S. B. HENDRICKS (Z. Krist., 1938, **99**, 264—274; cf. Gruner, A., 1934, 1162).—Single-crystal analyses by Weissenberg *X*-radiograms confirm cell data and symmetry. Comparison of observed intensities with those calc. from various arrangements of $[(OH)_2Mg_3Si_4O_{10}]_n$ and $[(OH)_2Al_2Si_4O_{10}]_n$ sheets eliminates structures compatible with a definite space-group. Layer combinations subject to random shifts of $n.b/12$ along the b axis are considered. I. McA.

Structure of pollucite, $CsAlSi_2O_6,nH_2O$. S. VON NÁRAY-SZABÓ (Z. Krist., 1938, **99**, 277—282).—Isomorphous replacement of Si and Al may occur in the above corr. formula. The pseudocubic cell with 16 mols., a 13·74 A., is probably tetragonal, with space-group D_{4h}^{20}—$I4/acd$ rather than O_h^{10}—$Ia3d$. At. parameters, determined in accord with *X*-ray intensities, yield a Si–Al–O framework of Si_4O_{12} rings (4 corner-linked SiO_4 tetrahedra) linked by like AlO_4 tetrahedra, with the Cs· 12-co-ordinated to O at 3·50 A., and a statistical distribution of H_2O. A similar disposition of Na· and H_2O (reversing Taylor's placings) is suggested for the parallel analcite structure. I. McA.

Structures of analcite and pollucite. W. H. TAYLOR (Z. Krist., 1938, **99**, 283—290).—The evidence, reviewed in the light of Náray-Szabó's suggestions (preceding abstract) for the Na· and H_2O positions, favours the original analcite structure (A., 1931, 550). I. McA.

Structure of analcite. S. VON NÁRAY-SZABÓ (Z. Krist., 1938, **99**, 291; cf. preceding abstract).—A reply to Taylor. I. McA.

Photochemical properties of sodalite from Kisshu, Korea. E. IWASE (Z. Krist., 1938, **99**, 314—325).—This variety (chemical analysis), with ρ 2·33 and n_D 1·485, occurring in translucent veins in nepheline, becomes pink when kept and shows the reversible photosensitivity of hackmanite (A., 1937, I, 204). The exciting λ is <4200 A., the absorption band ~4500—6000 A. Preheating at 230° inhibits coloration by ultra-violet light, but, with *X*-ray excitation, a more fleeting effect persists at 180—590°. Fluorescence and cathodoluminescence spectra show band peaks at 5880 and ~6380, 4230 and 6350 A., respectively; fluorescence is intensified and shifted to shorter $\lambda\lambda$ by preheating at 400°. Results for members of the sodalite family are compared. I. McA.

Spilitic rocks from Chitaldrug, Mysore state. C. S. PICHAMUTHU (Current Sci., 1938, **7**, 55—57).—The mineral constituents of the Jogimardi trap and the dark hornblende trap of Chitaldrug are briefly described. Three chemical analyses [E. R. TIRUMALACHAR] are given and compared with analyses of spilitic rocks from other parts of the world. L. S. T.

Felspars from the mica pegmatites of Nellore. N. JAYARAMAN (Current Sci., 1938, **7**, 57—58).—The most common of these differing types of felspar are an albite with approx. 10% Na_2O and an orthoclase with approx. 16% of K_2O. Appreciable amounts of perthites and microperthites, the most conspicuous being a green moonstone, and a flesh-red microcline are also present. The effects produced on heating are described. L. S. T.

Gold in the Liepvre-Chatenois region. E. F. MOPPERT and J. J. PITTARD (Bull. Soc. Ind. Mulhouse, 1938, **104**, 346—357).—The granite of this district is auriferous, but previous reports of the Au content are much exaggerated. L. S. T.